Enciclopedia en Español de Maquinaria para Minas Pagina 60

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Engineering and Mining Journal

McGraw-Hill Publishing Co., Inc., New York

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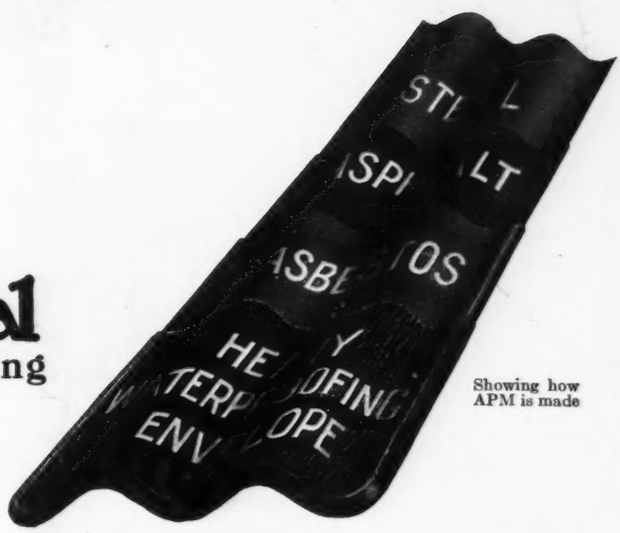
by the use of

Asbestos Protected Metal
Corrugated Roofing and Siding



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Pittsburgh. First National Bank Building

Canadian Asbestos Co., Montreal P. Q.
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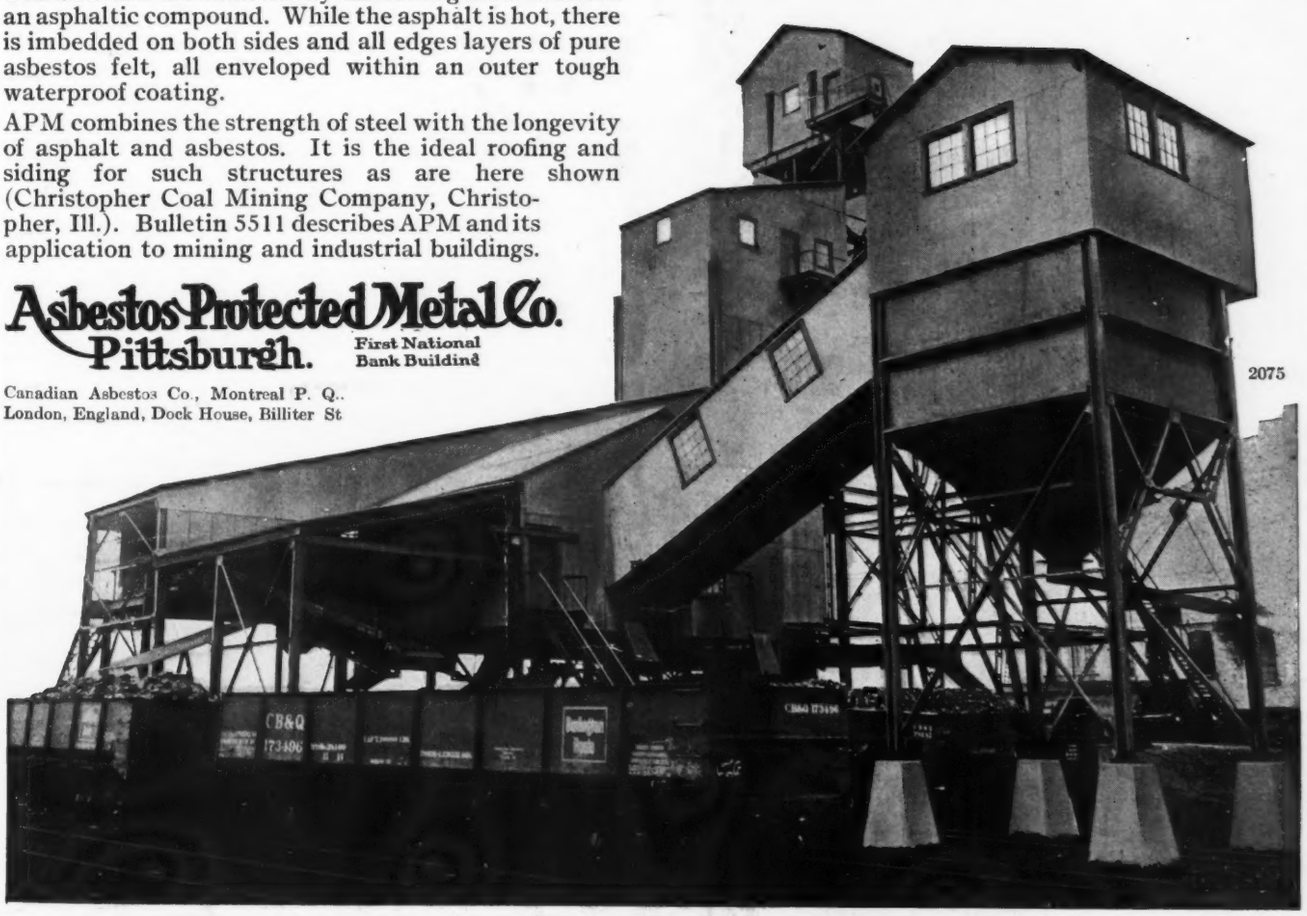

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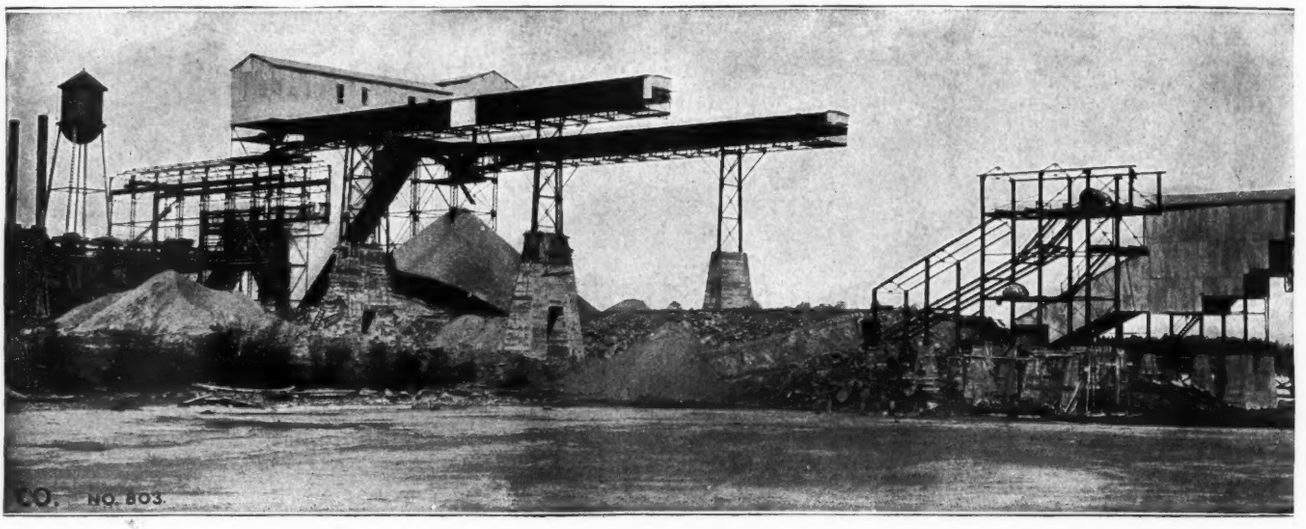
The S-A Page

Published Weekly in the Interests of S-A Conveying Engineering



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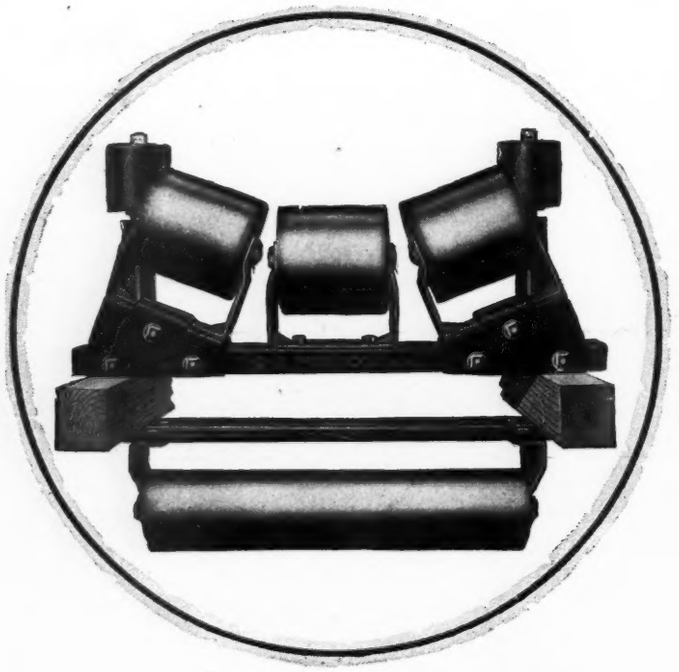

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Engineering and Mining Journal

VOLUME 104 NOVEMBER 24, 1917 NUMBER 21

Solving the Ore Treatment Problem at White Caps Mine

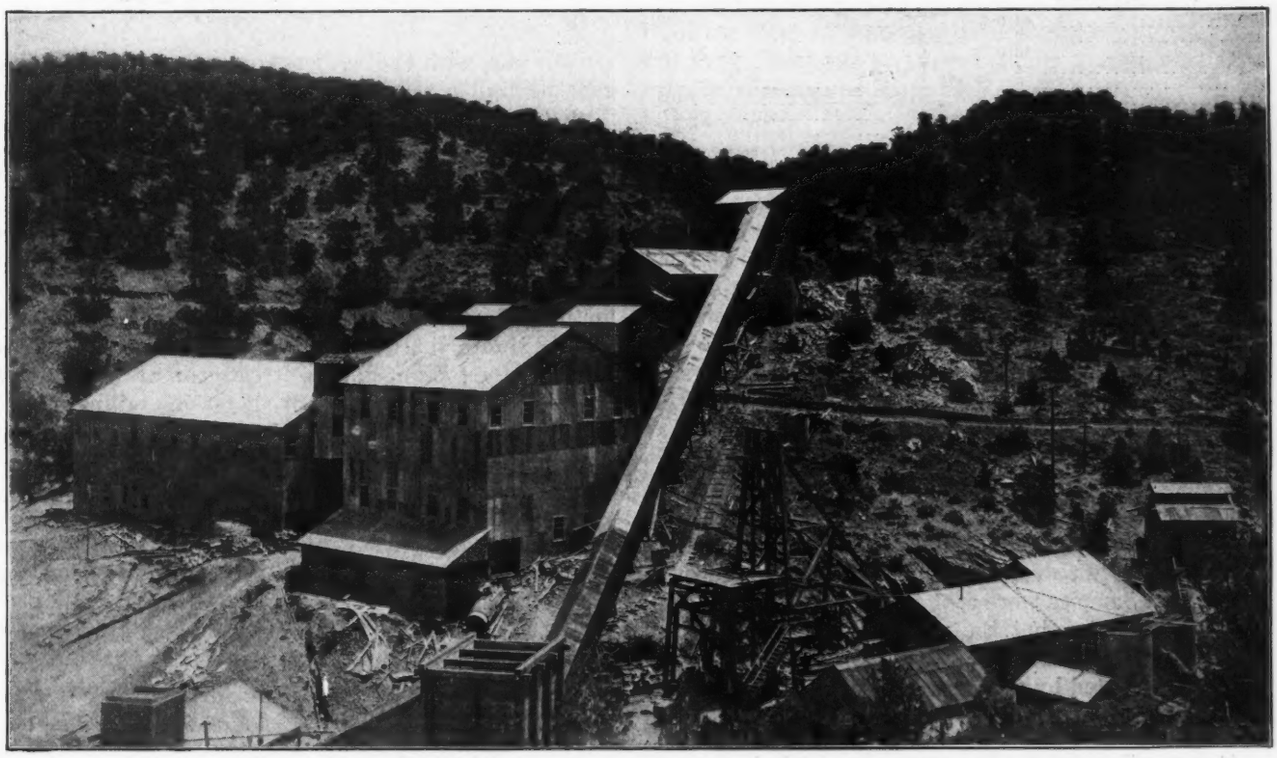
BY JOHN G. KIRCHEN*

The oxidized gold ore of the White Caps mine, at Manhattan, Nev., changed at 150 ft. to a refractory sulphide containing stibnite and realgar as well as iron and manganese. The new treatment plan is a carefully controlled roast followed by leaching with dilute, neutral cyanide solution. A 90% extraction is indicated at a total milling cost of $2 per ton.

THE mining town of Manhattan, Nev., has recently come into prominence through the discovery of high-grade gold ore in the White Caps mine. Manhattan is 45 miles north of Tonopah, the nearest railroad point, and was one of the early southern Nevada "boom camps." The capital interested was chiefly from San Francisco, and when the 1906 disaster occurred, the Manhattan boom collapsed.

*General manager, White Caps Mining Co., Manhattan, Nev.

Oxidized gold ore outcropped on the White Caps property and was followed by an inclined shaft to a vertical depth of 200 ft. The ore was treated in a local mill. At the 150 ft. depth, the water level was reached and the ore changed to a sulphide which was refractory to amalgamation or direct cyanide treatment. In 1912 a group of Tonopah men leased the property and erected a mill and cyanide plant of 75-ton daily capacity. By the time the lease expired, all the available oxidized ore had been worked out. Operations on company account were then resumed, and shipments were made of high-grade sulphide ore. However, as this was limited in quantity, and there was no method of treating the lower-grade sulphide ore, the mine was shut down. During this period a new, two-compartment vertical shaft was raised to the surface. Total production from these operations, exclusive of ore on dumps from recent development, was 19,909 tons, assaying $19.14 per ton in gold, and amounting to $381,053 in terms of gross value.



WHITE CAPS MINE AND MILL, MANHATTAN, NEV., LOOKING SOUTHEAST

In June, 1915, the White Caps Mining Co. was incorporated and took over all of the assets of the old Dexter-White Caps Mining Co. The new company began active work on the White Caps property, and a process was developed[1] for treating the sulphide ore. It was found that by roasting the ore within certain degrees of temperature the roasted product could be readily cyanided, and a good extraction obtained with a fairly low cyanide consumption.

In February, 1916, work was started sinking the vertical shaft to the 300-ft. level. By August of the same year the two main oreshoots had been cut on this level. Sinking was again resumed and the shaft sunk to the 425-ft. level on which the ore was cut in April, 1917. The ore occurs in a bed of limestone from 20 to 100 ft. thick, the limestone being cut by numerous faults into blocks up to 200 ft. long. Only two of these have been explored to date, and in them have been found the east and west oreshoots respectively. On the 425-ft. level, the east oreshoot was 195 ft. long, with a maximum width of 40 ft., and the west oreshoot was 90 ft. long, with a maximum width of 18 ft. It is difficult accurately to estimate tonnage and grade, but the ore so far developed is expected to exceed $20 per ton. A new mill, recently completed, consists of a crushing and cyaniding plant with an estimated daily capacity of 150 tons, and a 22½-ft. diameter, seven-hearth, Wedge mechanical roasting furnace. Crude oil will be used as fuel for the roaster.

Early Futile Attempts to Treat Sulphide Ore

The long delay in the development of the mine was due to the peculiar mineralogical composition of the deposit and consequent difficulty of treatment, rather than to any lack of ore. The form in which the gold occurs is not known. The 75-ton mill that was erected in 1912 was an all-sliming cyanide plant constructed by the Associated Milling Co. for treating the ores from the White Caps and other Manhattan properties. This mill was operated successfully for a year, during which time an average extraction of 92% was obtained. As already stated, the oxidized zone in these properties extended only to a depth of about 150 ft. When this point was reached, it was found that an extraction of over 50% could not be secured by the simple cyanide treatment, and consequently the mill was forced to suspend operations in June, 1913.

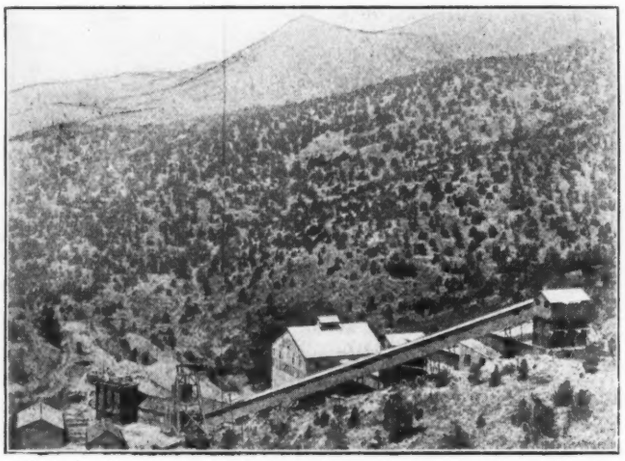
ANALYSIS OF LOW-GRADE WHITE CAPS ORE

Chemical Analysis		Mineralogical Analysis	
SiO_2	43.0%	SiO_2	43.00%
Al_2O_3	0.4	Al_2O_3	0.40
CaO	18.0	$CaCO_3$	32.15
MgO	4.0	$MgCO_3$	9.56
Fe	6.1	Fe_2O_3	3.98
Mn	0.2	FeS_2	7.07
S	4.3	MnO_2	0.32
As	0.6	As_2S_3	0.86
Sb	0.6	Sb_2S_3	0.84
Au	$16.00		

Then followed a period during which various efforts were made to discover some method of treating these base ores. Samples were sent to metallurgists and ore-testing companies, but the results of their tests were apparently unsatisfactory. Since the oxidized ore could be readily treated by cyanide, the idea of a preliminary oxidizing roast was one of the first to be investigated. However, because of conditions which will be explained later, these roasting tests were failures. In June, 1915, I took over the control of the White Caps mine, and exhaustive experimental work was begun, which finally ended in a satisfactory solution of the problem.

The accompanying table gives a typical analysis of the low-grade ore: After many tests it was found that the stibnite carried a small amount of gold, usually ranging from a trace to $2 per ton. The realgar carried more low-grade ore. After many tests it was found that the average of the ore. Most of the gold apparently is associated with a fine-grained black mineral which has not been identified. Tests for tellurium or selenium gave negative results. We were, therefore, forced to resort to the "cut-and-try" method of attacking the problem, until sufficient data could be collected to suggest a more scientific mode of procedure.

The first work was done on the raw ore, and the following results were obtained: Flotation tests with various oils, with and without preliminary sulphidizing, gave negligible results; the sulphides could be readily floated, but the gold content of the concentrates was little higher than that of the tailings; gravity concentration gave similar results; amalgamation gave low extraction, with fouling of the mercury. The following cyanide tests gave unsatisfactory results: Simple cyanide treatment, with various amounts of cyanide, alkali and lead salts; the bromocyanide process; preliminary treatments with caustic soda, sodium sulphide, sodium thiosulphate, cuprous thiosulphate and sodium sulphite; the sodium-sulphide treatment[2] of cyanide tailings; cyanide treatment of flotation tailings; and aluminum-caustic soda desulphurizing, followed by cyanide treatment.



WHITE CAPS PLANT, LOOKING NORTH, SHOWING TOPOGRAPHY OF MANHATTAN DISTRICT

Conclusions from the Tests

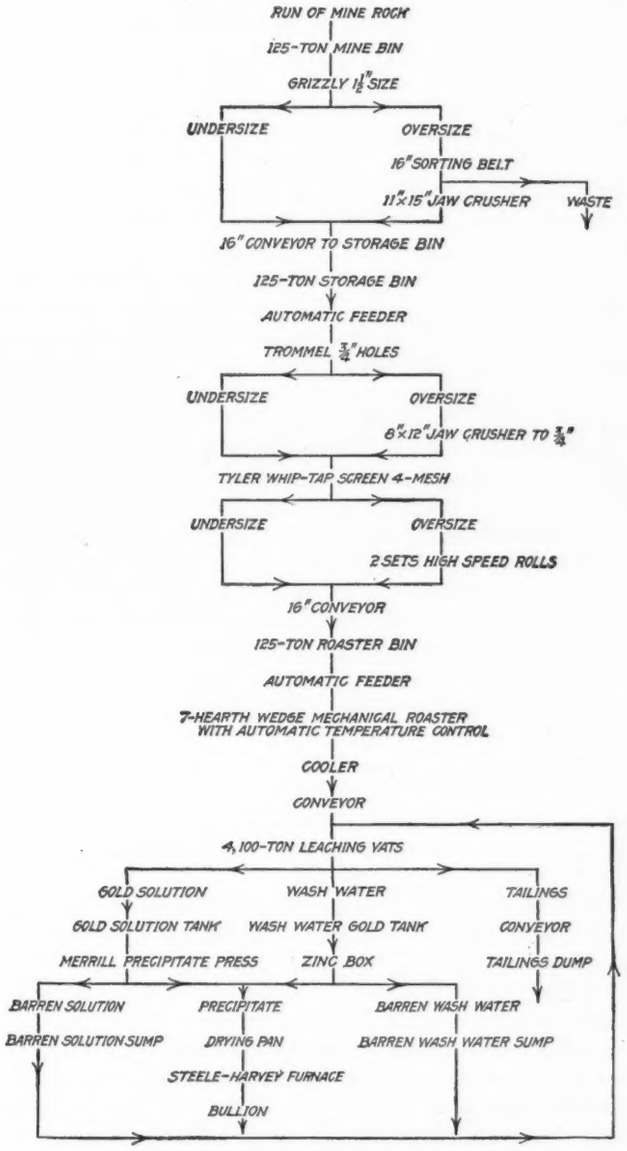
From the above tests the following conclusions were drawn: (1) The gold is not in a free state, since it cannot be amalgamated nor dissolved by cyanide even after the arsenic and antimony sulphides are removed by flotation or by preliminary treatment with alkaline sulphides; (2) the gold is probably not associated with the sulphides, nor combined as a telluride, as both grav-

[1] A new mill embodying this process has lately been put in operation.

[2] Described by W. R. Feldtmann, Bull. 127, I. M. M., Apr. 8, 1915.

ity concentration and flotation were unsuccessful; (3) it is possible that the gold is combined with the manganese, but there is not enough data at present to warrant any definite conclusion; (4) it is known that arsenic and antimony sulphides and manganese compounds are all, under some conditions, detrimental to cyanide treatment and also that roasting is the common method of handling these substances.

The calcines from an ordinary oxidizing roast at a temperature of 1500° F. yielded less than 50% extraction to cyanide treatment. The calcines contained



FLOW SHEET OF WHITE CAPS MILL AT MANHATTAN, NEVADA

unoxidized antimony sulphide. Addition of lead acetate was of little benefit. Treatment with caustic soda and thorough water washing, followed by cyanide treatment, gave better results, but the process was not commercially feasible. Chlorination was not considered practicable, because of the limestone gangue.

Specimens of pure stibnite were then roasted, and the following conditions observed: The oxidation of the stibnite was slow below a temperature of 800° F., but at this point the oxidation became rapid, and fusion took place at 850° F. After fusion, complete oxidation did not take place during eight hours of continuous rabbling at a temperature of 1600° F.

By careful temperature control, it was possible to oxidize the stibnite completely in six hours. This same procedure was followed with the ore, and good results were obtained by cyanide treatment of the calcines. Pure stibnite added to a duplicate of the above test lowered the extraction nearly 50%. However, a roast of six hours under Manhattan conditions would be expensive, and such accurate temperature control would be almost impossible.

It was found that stibnite was very slightly soluble in a pure dilute cyanide solution, but readily soluble in a caustic alkaline solution. Consequently, by keeping the temperature below 1050° F. (the decomposition point of calcium carbonate) the formation of caustic lime could be avoided and it would be possible to treat the ore with practically a neutral cyanide solution, which would not dissolve the antimony sulphide. The ore was, therefore, given a one-hour roast under the above conditions, and agitated in a neutral 2-lb. cyanide solution for one hour. An extraction of 90% with a cyanide consumption of less than ½ lb. was the result.

Leaching tests were next tried on the same type of calcines, and it was found that practically the same extraction could be secured by leaching a four-mesh product for 15 hours. A series of tests, re-using the same solution after zinc precipitation, showed no fouling of the solution and no difficulties in precipitation. Due to the excess of calcium sulphate formed during the roast, the slimes settle rapidly without the use of lime. After these results had been fully verified, plans were drawn up for the 150-ton mill, the details of the process being given in the accompanying flow sheet.

From roasting tests made on the ore by the Wedge Mechanical Furnace Co., it is estimated that the fuel-oil consumption will be less than 4 gal. per ton. On this basis the total milling cost, including crushing, roasting and cyaniding, will be approximately $2 per ton. The extraction should be about 90%. I take this opportunity to acknowledge the valuable assistance rendered by D. B. Bradner, whose untiring work developed the data from which a solution of the metallurgical problem of the White Caps ore was possible.

Platinum Metals Co. Not Employed on Government Work

Because of reports that the Platinum Metals Co. of Philadelphia, Penn., is testing platinum-bearing materials for the Government, the U. S. Geological Survey has pointed out that, although the Survey is studying the platinum deposits of the United States, it has sent no materials to the Platinum Metals Co. for testing. Furthermore, it has not investigated the so-called "amagnite process" for saving platinum, though it has received a few samples of so-called "amagnite" from the company. Included in the advertising matter issued by this company is a copy of a letter addressed to the Survey's specialist on platinum by the company itself; the Geological Survey announced that no statement in this letter is indorsed by a Government official, even if this impression may be created.

Industrial Uses of Antimony*

By K. C. Li†

The industrial applications of antimony are principally as an alloy, the three most important being babbitt metal, type metal and Britannia metal. Antimony compounds, especially the oxides, are used in enameling and as pigments; the sulphide is extensively used in coloring and in vulcanizing rubber.

ANTIMONY is one of those metals which have been brought into great prominence by the deplorable war now raging in Europe, but apart from its destructive uses in warfare it has numerous other uses which have proved beneficial to commerce and to mankind generally. I shall discuss the latter in detail beginning with the better-known uses and passing on to those which are not so well known. Pure antimony is hard but brittle and on that account cannot well be used alone for manufacturing purposes. It therefore is commonly employed as an ingredient of certain alloys. The principal uses of antimony may be enumerated as follows:

1. Babbitt Metal. The best known of the antimony alloys is what is generally known as bearing or babbitt metal. This is an alloy composed of tin, antimony and copper mixed together in varying proportions depending upon the amount of pressure likely to be brought to bear upon the metal. As its name indicates, it is used for making machine bearings, the qualities of which should be hardness, toughness, and smoothness. The antimony gives the necessary hardness, while the tin and copper render the metal tough, and enable it to take on a smooth surface. A large number of compositions for babbitt metal have been given in books and papers, and I will cite only one or two.

BABBITT OR WHITE METALS

	Sb	Pb	Sn	Cu	Zn
Light loads	12%	.....	80%	8%	...
Heavy loads	8%	.....	90%	2%	...
Medium loads	16%	.....	76%	8%	...
Heavy axles	18%	.....	72%	10%	...
Light axles	77%	.....	17%	6%	...
Very hard metal	82%	.....	12%	4%	2%
Magnolia metal	16.5%	83.5%	....	...	...

2. Type Metal. Next to babbitt metal in importance comes the well-known alloy called type metal. This is a composition of lead, antimony, and tin. Type metal must have the type clear-cut and of sufficient hardness to resist the pressure of printing. The antimony gives the necessary hardness and also helps to perfect the molding of the letters. The usual formulas of this alloy are given in the accompanying table.

COMPOSITION OF TYPE METALS

	Sb	Pb	Sn	Cu	Zn
French	30%	55%	15%	...	...
Hard lead	20%	80%	....	...	...
No. 1 English	18%	62%	20%	...	...
Monotype	19%	70%	11%	...	...
Stereotype	14.8%	80.7%	4.8%	...	...
Linotype	12.5%	85%	2.5%	...	...

3. Britannia Metal. A third alloy of antimony which is fairly well known is that named Britannia metal. It is an alloy consisting of tin and antimony containing up to 20% of antimony with small percentages of copper or other metals. The metal is used for making teapots, spoons and various other articles for domestic use. In this alloy antimony is again used for its hardening effect, and probably also because it is practically a non-oxidizing metal and renders the alloy less susceptible to rust. The compositions mentioned in the table are common, but there are many others with only slight variations.

COMPOSITIONS OF BRITANNIA METALS

	Sb	Pb	Sn	Cu	Zn
English	10%	....	86%	1%	3%
Best	10%	....	90%	...	...
German	9%	....	84%	2%	5%
German (for castings)	64%	....	20%	10%	6%

I canvassed a number of antimony consumers for the purpose of ascertaining what use they made of antimony and the information elicited by these inquiries may prove interesting.

Minor Applications of Antimony

4. Battery Plates. Several manufacturers of accumulators and storage batteries use antimony in the manufacture of the grid or framework of the battery plates. The antimony is mixed with lead in varying proportions according to the class of work for which the battery is used. The addition of antimony serves a double purpose: It strengthens the framework and at the same time reduces the weight slightly.

5. Toys. Antimony is used to some extent in toy making, and one toy maker stated that antimony was used for the following reasons: "Toys cast of pure lead are heavy and bend easily. By adding antimony the weight is reduced and the strength is increased to such an extent that the toys can be made thinner, thus using less material. From 3 to 25% of antimony may be used."

6. Siphon Tops. Another inquiry brought out the fact that antimony is used to harden the tin employed in the manufacture of siphon tops.

7. Cable Covering. I have recently been informed that a large Canadian concern has carried out a series of experiments to determine whether antimony could be used instead of tin in the manufacture of lead-covered electric cables. It is said that these experiments have been successful, and if so, it means the opening up of a new field for antimony. The substitution of antimony for tin always leads to a large reduction in cost.

8. Shrapnel. Antimony at present is most extensively employed in the manufacture of ammunition. It is used in the making of chilled shot as well as for most bullet mixtures. Its chief purpose is as a hardening agent. In shrapnel bullets lead is required to give the necessary weight, and antimony is added to make the bullets sufficiently hard to withstand the shock caused by the explosion of the shell. The amount of antimony is from 12 to 25%. An 18-lb. shrapnel shell contains about 8 lb. of bullets, the composition of the bullets being about 82½ parts lead to 12½ parts of antimony.

*Excerpt from a paper entitled "Antimony, Its Metallurgy and Uses," read before the American Institute of Metals and reprinted from its "Journal," Vol. 11, No. 1.

†Mining engineer and metallurgist, Woolworth Bldg.; representative in New York of the Wah Chang Mining and Smelting Co., Ltd., Changsha, China.

There is therefore about 1 lb. of antimony in an 18-lb. shell. When one considers the millions of shrapnel shells that are being made at present, one can easily understand the present activity in antimony.

9. Hard Lead. Antimonial lead, or "hard lead," is now being extensively used in acid works in making pumps and pipes, and is also replacing soft lead in the lining of acid-proof chambers. Other uses, as for coffin metal, etc., of less importance, are omitted here.

Uses of Antimony Compounds

1. Antimony White Oxide. A large number of experiments have been carried out with the object of substituting antimony oxide for tin oxide in the making of enamels. The experiments were in the beginning not especially encouraging, but ultimately it was found that antimony oxide could be used with success. In order to produce a satisfactory antimony-oxide enamel much greater care must be exercised than in the case of tin-oxide enamels. This extra care is rendered necessary, first because of the difficulty of controlling the color; second, because of the liability of dark specks to appear; and, third, because of the danger of poisoning. The whole subject of antimony-oxide enamels was ably discussed in a paper read before the American Ceramic Society in February, 1915, at Detroit, by Prof. Homer F. Staley. I take the liberty of quoting a summary of his paper: "Oxide of antimony enamels of good gloss can be made from three types of formulas: (1) The high boric oxide, no lead type; (2) the medium boric oxide, no lead type; (3) the low boric oxide, lead-bearing type. With reference to color, oxide-of-antimony enamels contain three color components: (1) Tan, probably due to sulphur and fading as the smelting continues; (2) a yellow, due to lead oxide and persistent; (3) a blue, due to combination of antimony oxide, boric oxide, calcium and fluorine, which grows more intense as smelting continues. Opaque whites are produced by controlling the heat treatment and composition so that the tan and yellow are neutralized by the blue. The dark specks in antimony-oxide enamels are due to contamination with organic or metallic dirt after the enamel is smelted. The remedy for this is extreme cleanliness."

Sulphide Used in Rubber Industry

2. Antimony Sulphide. Rubber vulcanizing is a process in which there is an increasing demand for an antimony compound. Vulcanized rubber is used for various purposes, chief of which is the insulation of electrical conductors. The red trisulphide of antimony is fused with sulphur, thus being converted into pentasulphide. The product is dissolved in a solution of sodium sulphide, and on the solution being evaporated the pentasulphide crystallizes out as a red powder. In the vulcanizing process this powder parts with the excess of sulphur and is reduced again to the trisulphide, which mixes mechanically with the rubber, giving a red color.

3. Pigments. Still another field in which antimony compounds have been used is in the manufacture of pigments or paints. Many different colors and shades of color are obtained from antimony compounds. When roasting furnaces (as in Herrenschmidt's method) are used for antimony smelting, trioxide of antimony is formed as a fine, white powder in the flues and dust chambers of the furnaces. It may be collected in this form and used as a pigment without further treatment. This product is commonly called "antimony white." This paint can withstand the action of water, is durable for outside work, is non-poisonous and comparatively cheap.

"Antimony black" is a pigment used for bronzing metals and plaster casts. It is metallic antimony which has been deposited electrically or chemically as a fine powder from a solution containing antimony. A fine vermilion color is obtained by precipitating the red trisulphide of antimony from solution, with sulphuretted hydrogen. As a pigment the antimony vermilion is in many ways superior to red oxide of lead, red chromate of lead, or mercury vermilion. Antimony vermilion is a pigment specially suited for oil painting, and its low cost and covering power render it advantageous for carriage and house painting. A yellow pigment is produced by the slow oxidation of antimony sulphide. This is called "antimony yellow." Various shades of yellow can be obtained by mixing different proportions of antimony yellow with other mineral compounds.

4. Glass Making. When antimony tetroxide is fused with antimony sulphide in suitable proportions, the resulting product is the trioxide, which always contains more or less of the sulphide. The color of the impure trioxide varies according to the quantity of sulphide it contains. This is known as "antimony glass" and is used as a coloring matter in glass making and in the preparation of the yellow background and of carnation in the decoration of pottery.

5. Safety Matches. Still another antimony compound is used in the process of making safety and wax matches, as well as in the composition put on the side of the box for the purpose of striking the matches. The heads of the matches contain about 3% of the trisulphide of antimony, while the composition on the box contains about 8% of the same material. The antimony trisulphide used is in the form of powdered antimony crude.

There are several other uses to which antimony and antimony compounds may be put, but these have not attained sufficient commercial importance to warrant their discussion at present.

Employer's Liability in Arizona

By A. L. H. Street*

Under the Arizona statute an employer is liable for injury sustained by his employee, regardless of negligence, if the employee was not himself at fault. The supreme court of the state recently affirmed judgment in favor of a mine employee who was injured by the escape of compressed air used in ventilating the mine, when he opened a valve under circumstances which involved no contributory negligence. (Inspiration Consolidated Copper Co. vs. Mendez, 166 Pacific Reporter, 278.) The law is upheld as being a valid measure, subject to exemption of liability where the injured employee has been guilty of contributory negligence or has disregarded plain warning of danger given him by his employer.

*Attorney at law, 829 Security Bldg., Minneapolis, Minn.

Collahuasi La Grande Copper Mines, Tarapacá Province, Chile

BY PAUL T. BRUHL*

The Collahuasi La Grande mines, owned by a French company, are in a rugged region of the Andes, at about 16,000-ft. altitude. Igneous rocks predominate and lodes are generally faulted, the dip varying considerably. Orebodies are irregularly distributed lenses or chimneys. High-grade ore carries 22.5% Cu, but during the war 11% ore yields a profit. Simple concentration is now employed, but it is believed that flotation might render available large deposits of 5% copper ores.

THE Collahuasi La Grande mines are situated in the province of Tarapacá, Chile, about 50 km. by rail north of the important seaport of Antofagasta, and are under the direction of the Société Française des Mines de Cuivre, a French company with head offices in Paris. As the mines are at an altitude of nearly 16,000 ft., the trip is best made in three stages. The first stop-over is at Calama (8000 ft.) and the second at Ollagüe (12,000 ft.). It is unwise for a man not accustomed to high altitudes, even though he be physically fit, to be impelled by the desolation of a dusty landscape and the many inconveniences of the hotels to make the journey a continuous one, for if that be attempted he lays himself open to a possibly fatal attack of *puna*, or mountain sickness.

The scenery at the mines is wild and rugged, and similar to that of some parts of the State of Nevada. The vegetation consists of semicircular tufts of a coarse grass, and in the warmer months a few small flowering plants are found in the valleys. In the district are five volcanoes, ranging in height from 17,000 to 20,000 ft. Three of them are active, as they emit fumes, and two are extinct. Andesites, porphyries and felspathic rocks are the principal formations in the district. The lodes are usually faulted at points where they are traversed by dikes of quartzose porphyry, diabase and diorite, which in general have a northeasterly strike. The orebodies are irregular in occurrence, and are usually in the form of great lenses or rich chimneys, some of the latter containing perhaps a thousand tons of 35% ore. The various lodes dip and strike at different angles, and the same lode may dip in opposite directions within a short vertical distance. The entire district, for a few miles round the principal claims, shows surface indications of copper, and numerous prospecting shafts have been sunk, but without disclosing deposits of value. Some of the samples taken a few feet below the outcrop assayed between 20 and 30% copper, but as the ore deteriorated in grade at shallow depth, further sinking was abandoned. There is a well-defined silver-bearing lode near-by, which was worked about 15 years ago, the hand-picked ore being carted for treatment to a 10-stamp mill. The average of a number of samples which I took in the old workings was 2 oz. of silver per ton, and a selected specimen assayed 14 oz. of silver, with a trace of gold. A high-grade sulphur deposit is worked on the northern slope of the volcano of Olca,[1] east of which mountain lie extensive "bad lands."

OLCA VOLCANO, ALTITUDE 17,500 FT., IN PROVINCE OF TARAPACÁ, CHILE

The following ores of copper are found in the mines of the district: Silicate of copper, copper glance, bornite, chalcopyrite, brochantite, cuprite, tenorite and olivenite. Native copper has also been found, but in unimportant quantities. Prior to the war only the deposits assaying 18% copper were considered profitable; contracts were made later for 11% ores. A typical analysis of the high-grade ore is: Cu, 22.5%;

*Care of Nevada Consolidated Copper Co., McGill, Nev.

[1]The sulphur deposit was mentioned, and the summit of the volcano illustrated, in the "Journal," pp. 289-293, Aug. 12, 1916.—Editor.]

SiO_2, 49.5; Fe_2O_3, 7.9; Al_2O_3, 1.5; CaO, 1.25; S, 3.85, moisture, 1.25; Ag, 9.8 oz.; Au, 0.1 oz. The ore in one of the mines at times assayed 2% Mn, and in another 45% Fe_2O_3.

The ancient method of mining was of the crudest description, consisting of a network of burrowings in the richest portions of the lode. At present, overhand stoping is practiced in an orderly and methodical way. The drums at the primitive shafts are vertical, and rotated by mules harnessed to horizontal beams fixed at the base of the drum. The modern shafts are equipped with steam-driven hoists. Elaborate pumping installations are unnecessary, and little timber is required, especially in the upper levels, where the ground is frozen for many months in the year. In the early days the ore was carted over the company's road to the port of Iquique. A branch line from the Antofagasta & Bolivia Ry. now runs directly below the bins. The contract system at first in vogue has been replaced by a system of piecework. Men working in ore are paid so much per ton of ore placed at the surface; men in barren ground so much per running meter, and bonuses are given. Shift pay is inadvisable underground unless there is ample supervision. The Boliviano is the most suitable miner, as he is accustomed to high altitudes and is a steadier worker, and more easily handled, than the independent Chileno. The government stipulates the proportion of Chilean labor to be employed.

MARITATA, OR HAND JIG, USED AT THE COLLAHUASI MINES, CHILE

Recovery by Concentration Is Low

An aërial tramway connects the main shaft and dump with the mill, which is situated over the hill in the valley beyond. On the dumps are about 90,000 tons of 10% copper ore. The mill has a simple flow sheet, the equipment consisting of crushers, jigs, Wilfley tables, and Frue vanners. The heads ran about 8% Cu, the tailings 4 to 5% Cu, and the concentrates 20 to 25% Cu. The recovery could undoubtedly be improved by fine grinding of the jig tails and table middlings, and sending them, together with the vanner slimes, through a flotation machine. Preliminary tests showed that the copper content of the tailings could be reduced to 0.75%. There is a good deal of impregnated quartz assaying 4 to 6% Cu, which it is impossible to concentrate. The plant had to be closed down owing to the scarcity of *llareta*—or *yareta, fungus cordillerensis*—a fuel of fair calorific value but high in ash. The installation of oil burners beneath the boilers has permitted, I am told, resumption of milling activities. The dumps have been sorted over roughly from time to time, and the product has been treated on *maritatas* or hand jigs. Sorting is best carried out in the spring and summer months, as during the thaw the sulphide particles, which have been fractured during the winter, fall away from the gangue. For this reason the dumps are said to "grow."

In two of the *quebradas* or valleys are old slag heaps and small reverberatory furnaces, said to have been erected in the early days of the Spanish conquest, but I do not consider this likely, owing to the remoteness of the region and the modern design of the furnaces. The slag assays from 3 to 4% Cu, which is not bad practice, considering the poor quality of the fuel. It is hand-jigged to give a 17% product, 11% of which is in the form of metallics.

Sampling of the Ore

Each car is loaded with about 260 sacks of ore, with a total weight of 20 to 21 tons. When the carload comes solely from the yard crusher, every twelfth sack is set aside for the sample. At times, however, a load may consist of ore from three different mines, as, for example: Mine *A*, 160 sacks; mine *B*, 60 sacks; mine *C*, 40 sacks. Twelve sacks are taken of each lot. Mine *A* sample is reduced by hand to 6 sacks, mine *B* to 2¼ sacks, mine *C* to 1½ sacks, and the correct amount by weight goes, after reduction to ¼-in. size, to a small automatic sampler. A relatively larger initial sample is taken from mines *B* and *C* than from mine *A*, because the sacks from them contain ore of varying grade. The assay values as determined at the mine agree reasonably closely with those resulting from a sample taken in Europe. The ore sent in by contractors is handled in the same way, 10% of the sacks being reserved for sample. Ore trammed in from the main shafts is scoop-sampled as it enters the bins. When a contractor employed at jigging the dumps wished to make a consignment, a sample was taken at the dumps by quartering 10% of the cans, which were not taken at random, but so selected as to give a fair and representative sample. This first sample was taken to see whether the picked ore and the jig concentrates were of high enough grade. If the assay proved to be satisfactory, the ore was weighed and passed to the bins, where a second sample was taken as a check on the first and as a safeguard against the addition of poor ore after the first sample had been obtained. The two assays agreed closely.

To sample the unsacked ore loaded from the bins into gondola cars, a slot 4 in. square (large enough to take the largest piece of ore), was cut in the floor of the chute and provided with a three-sided baffle and a small

chute leading to the sampling floor. By this means 10 to 20% of the ore can be taken for the sample, depending on the rapidity of loading. Crude as the method undoubtedly is, it nevertheless yields satisfactory results for a big shipment. The cyanide method was used in making the copper determinations, except in the case of the ores from one of the mines when interfering elements were present. The monthly composite sample of the ore despatched for shipment was assayed by both the cyanide and iodide methods.

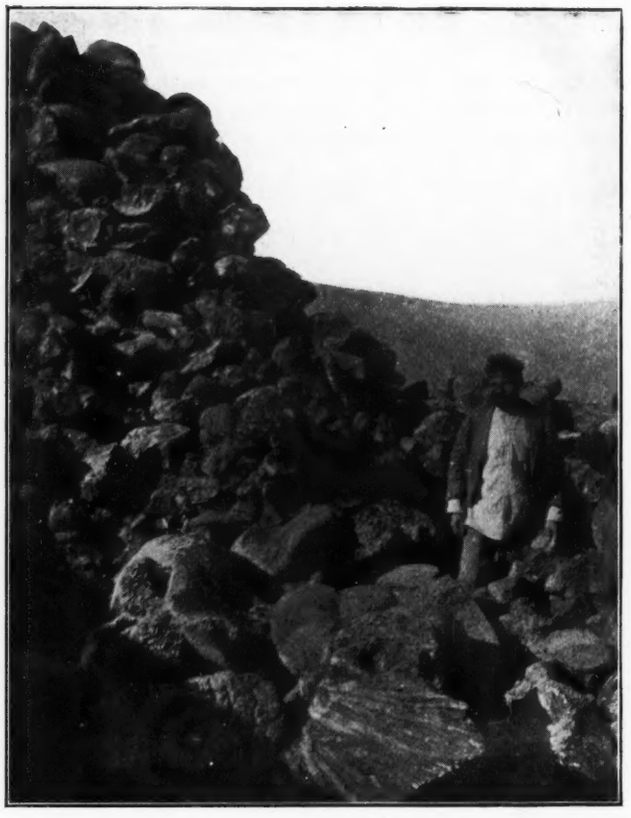
Bookkeeping in the Technical Department

Four books are used. No. 1 is the "metal book," which states day by day the weight of ore brought in, from where and by whom, together with the assay value. The book enables one to see at once the month's output on any particular date, and also the quantity of ore despatched. Book No. 2 has a numbered page for each miner, which is subdivided as follows: Tons of ore; meters driven; a number referring to book No. 3; price; and sum earned. Book No. 3 contains in the opening pages the contracts for "meters driven," and, further on, the tons of ore sent in by each *cuadrilla* or gang. It contains the total work done and sum earned by the gang. The sum to the credit of each individual member is entered in book No. 2. The page is subdivided as follows: Names of *cuadrilla;* tons of ore; price; total; a number referring to book No. 1; and the number of each man in book No. 2. Book No. 4 gives in alphabetical order the name and number of each miner in book No. 2.

The monthly cost sheet is presented in the following way· Leaf (A) total exploratory work; (B) total costs of mine "X"; (C) total costs of main ore yard per ton of ore; (D) total costs per ton placed in the yards of the various mines; (E) total costs per ton placed on the railway; (F) total costs per ton of ore handled on the property; (G) distribution of workshop expenses; leaf (H) all other expenses.

Employees are paid every two or three months so as to minimize loss of time due to the celebrations which go hand-in-glove with payday. Too scrupulous an observance of the numerous fiestas of the Spanish calendar is not permitted; the officially recognized holidays being the independence days of Peru, Bolivia and Chile, and Christmas.

The climate is healthful, cold and dry. Carcasses of animals do not putrefy on exposure, but, gradually becoming desiccated, are scattered by the wind. Radiation is sufficiently intense to cause the skin to peel off at the end of a day's outing. The snowfall is not usually heavy, and the snow does not lie long on the hillsides. The wind rarely attains a high velocity, corresponding in general to the figure 3 in the Beaufort scale,[2] in which 12 is regarded as a wind of hurricane force. During the 15 months I spent in the district it seldom rained, the upper atmosphere being cold enough to cause a precipitation of all moisture in the form of snow, hail, ice needles or frost. The last, I noticed, lay most thickly on a granitic formation across the valley. The electrical phenomena are interesting. To comb or brush one's hair, unless it has been well wetted, is at times impossible. A dull glow can be produced by merely crumpling a piece of paper, and a spark obtained by placing a finger ⅛ in. from a brass bedstead. The removal of a woolen vest recalls memories of an enthusiastically observed Fourth of July. At certain periods of the year the lightning storms are both violent and dangerous; usually, however, the lightning is of the *resplandores* type—that is to say "heat lightning"—close to the horizon and in the vicinity of the active volcanoes. Earthquakes are infrequent and of low intensity. The barometer remains generally between 380 and 385 mm. (15 and 15.2 in.) mercury pressure. The



PILE OF "FUNGUS CORDILLERENSIS," USED AS FUEL IN SOME CHILEAN MINING DISTRICTS

game in the district includes duck, wild geese, partridges, an occasional ostrich, rock rabbit and vicuña.

Observations have been made on the probable causes of *puna*, and although no definite conclusion was reached, it was thought that the malady develops from the effect on the blood of the intense radiation. It is not due directly to altitude, as in Bolivia the Indians speak of a *puna* belt above which no ill effects are noticed. The symptoms are either a great dizziness or an agonizing headache, which may be relieved by purgatives and a few drops of ammonia in a glass of water.

Tarapacá offers many attractions to capital. The copper deposits are of great extent, and large quantities of ore assay over 5%. The sulphides of copper occur in sufficient quantity to justify the installation of a large flotation plant, as they are easily floated and yield high-grade concentrates.

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[2]This value of 3 is regarded as equivalent to a wind velocity of about nine miles per hour and is sometimes rated as "gentle breeze."

National Rivers and Harbors Congress will hold its fourteenth annual convention at Washington, D. C., Dec. 5-7. Its slogan is "Use the waterways and win the war."

Metallurgy of Titanium Ferroalloys*

Titanium alloys are manufactured from rutile, ilmenite and titaniferous magnetite, the first-mentioned being the most important commercial source. Extended use of titanium alloys in steel metallurgy largely due to A. J. Rossi. Titanium acts as a deoxidizer and denitrogenizer and has great affinity for slag. Effects in metallurgy of iron not yet clearly established.

IT IS a singular fact that whereas in most instances a commercially successful product is the result of the labor of many men, the wide use of ferrotitanium is directly due to the work of one man, A. J. Rossi, dean of titanium investigators. The service that titanium in the form of its ferroalloys renders to the iron and steel industry is one that is becoming more indispensable as the demands for quality become more exacting. A large industry has been reared upon the exploitation and sale of such an alloy and in another plant it is one of the principal products made. The success of Rossi after many years of endeavor is sure to reawaken the latent interest in other of the now more or less rare elements, including boron, calcium, strontium, barium, zirconium and others.

Elemental titanium has not been used to any extent but its alloys have found far-reaching employment in the metallurgy of iron and steel and in nonferrous work. Recent developments in the use of the electric furnace, with its concomitant high temperatures, have encouraged the exploitation of processes for the reduction of titanium from its mineral ores, as well as the manufacture of titanium alloys on a large scale.

Rutile, Ilmenite and Titaniferous Magnetite Are the Commercial Sources of Titanium

Titanium is a constituent which is characteristic of certain pyrogenetic compounds. The commonest occurrences are as ilmenite, $FeTiO_3$; rutile, TiO_2; titanite, $CaTiSiO_5$; and perofskite, $CaTiO_3$; and it is often concentrated in beds of titanic iron ore. The source of commercial titanium is confined exclusively to the titanium ores, namely rutile, ilmenite and titaniferous magnetite, the most important of which at present is rutile. The known distribution of rutile in commercial deposits is limited indeed; the more important ones are confined to two localities in Virginia and one each in Canada, Europe and Australia. In Norway the mineral is found as a large aplitic dike near Kragero on the southeastern coast. The only commercial occurrence of rutile in Australia is near Mt. Crawford, but other non-commercial occurrences are known. The rutile deposits of Virginia are described at length by T. L. Watson and S. Taber in a bulletin, "The Titanium and Apatite Deposits of Virginia." These deposits are of particular interest because of their scientific and commercial importance and are at present the only known workable rutile deposits in the United States. Practically the entire production of rutile in Virginia has been turned out by the American Rutile Co. in its mill at Roseland.

A large number of binary and a few ternary alloys of titanium have been investigated by metallographic methods but the only alloys on the market for commercial consumption are ferrocarbon-titanium, ferrotitanium, cuprotitanium and manganotitanium. The alloys of titanium with iron were the first to receive marked attention, and of late years their use has increased largely, particularly by reason of their being employed as purifiers in iron and steel metallurgy.

As already stated, the present presence of titanium as an active agent in the iron and steel industry is directly due to the labors of A. J. Rossi, who has devoted some 30 years in this field. Abroad, H. Goldschmidt brought out the first successful practical process for the reduction of titanium from its ore by means of his now well-known alumino-thermic method.

Reduction of Titanium from Ores

Closely related to the subject under discussion may be mentioned the important problem of the reduction on a large scale of titaniferous magnetites which confronts American iron makers. Large bodies of easily mined titanium-bearing magnetites have been discovered from time to time, and a considerable mass of literature is at hand dealing with their geological occurrence and probable economic value. The approach, in the not far-distant future, of the possible exhaustion of the deposits of nontitaniferous iron ores and the present use in blast-furnace plants of lower-tenor iron ores point the way to the necessity of turning to the titanium-bearing material for smelting.

The general feeling among works managers is that iron ores containing in excess of 1% of titanium are difficult to smelt in the furnace in spite of the demonstrations of Rossi and other workers to the contrary. The recent able dissertation[1] by Joseph T. Singewald, Jr., gives the most complete and latest account of the situation. Prominent workers in the titanium field, in addition to those already mentioned, have been Haanel, Forbes, Corse, Comstock, Waterhouse and others.

Rossi's Early Work

For the sake of clearness it is well to distinguish between the two most prominent titanium alloys on the market; these are the ferrocarbon-titanium of the Titanium Alloy Manufacturing Co., Niagara Falls, N. Y. (the Rossi interests), and ferrotitanium, the carbon-free product of the Goldschmidt Thermit Co., New York. Rossi's work, leading to the production of what is now known as ferrocarbon-titanium, is summed up for brevity in the following: He procured a patent in 1892 pertinent to the reduction of titaniferous ores in the blast furnace; shortly afterward he attempted to make an iron-titanium alloy in the blast furnace and crucible but was unable to obtain a product rich in titanium. Experimental work conducted with the electric furnace resulted in the production of a commercial iron-titanium alloy for use in steel and iron metallurgy.

The carbon-free product of the Goldschmidt Thermit Co. contains from 5 to 6% of aluminum alloyed with the titanium. This alloy has been used for a number of

*By Robert J. Anderson in "Iron Trade Review," Aug. 16, 1917, by courtesy of the publishers.

[1]Bull. 65, U. S. Bureau of Mines, Washington, D. C.

years in European steel works as a final deoxidizer in casting practice. The titanium alloys, when made by the alumino-thermit process, are more expensive than those made in the electric furnace, and this is a cogent factor militating against their use.

Ferrocarbon-titanium contains from 5 to 8% of carbon, mostly in the form of graphite, the combined carbon being present in small amount. Analyses show the relative amounts of combined and graphitic carbon in four samples of this material to range from 6.234 to 9.601% of graphitic carbon and 0.118 to 0.147% of combined carbon.

The ferrocarbon-titanium has an average analysis as follows, according to the manufacturers: Silicon, 1.41%; titanium, 15.79; carbon 7.46; manganese, 0.11; aluminum, 0.80; phosphorus, 0.05; sulphur, 0.08; iron (by difference), 74.30; total, 100%. The alloy sold is guaranteed to contain at least 15% titanium.

Dr. Goldschmidt has said that carbon-free metals dissolve with greater ease than those same metals containing carbon, because the carbon is present in the form of carbides in the latter. Charles V. Slocum, on the other hand, found that the carbon-free alloy was not at all adapted to the metallurgy of iron and steel in the rôle of a deoxidizer and purifier. Without regard at present as to which view is correct it may be stated that both alloys have found employment. The Goldschmidt alloy has the following average analysis: Silicon, 1 to 1.5%; titanium, 25; carbon, *nil;* manganese, *nil;* aluminum, 5 to 6; phosphorus, 0.05; sulphur, 0.01; and the remainder is assumed to be iron.

Mode of Manufacture

All of the iron-titanium alloys now made, whether carbon-free or not, are made either by the reduction of titaniferous ore in the electric furnace with carbon, or by the Goldschmidt thermit method, since a method giving 2000° C. or over is required for the reduction of TiO_2. Most of the production is now made by the first-named process. In one of the Rossi processes the reduction may occur in a bath of aluminum, the aluminum, in ingots or any other convenient form, being melted in the electric furnace. Pig iron or scrap iron is then added to the charge, and next rutile is introduced. The temperature of the bath is then raised to a point required to start the reaction whereby the aluminum combines with the oxygen of the rutile. By this reaction

$$3TiO_2 + 4Al = 2Al_2O_3 + 3Ti$$

the rutile is reduced to metallic titanium which alloys with the iron. The product obtained in this manner is practically carbon-free.

In the event that ilmenite or titanic iron ore is used in place of rutile, a much larger amount of aluminum is required to reduce the ferric oxide, thus increasing the cost of manufacture because the iron can be more economically reduced by other methods.

Carbon Now Used Instead of Aluminum Bath

Where the alloy is prepared by reducing oxide of iron and titanium with carbon in the electric furnace, the product contains from 5 to 9% of carbon, mainly in the form of graphite. Carbon is at present used exclusively by the Titanium Alloy Manufacturing Co., replacing the aluminum-bath method once used. The process is described at length in letters patent, both domestic and foreign. In U. S. Pat. 609,466, Aug. 23, 1898, Rossi specified the reduction of titaniferous ore and rutile by means of carbon in an electric-resistance furnace, with the production of a ferroalloy containing over 5% of titanium and some carbon, the reduction occurring in a bath of molten iron. Titaniferous slag was also to be treated in a similar manner in a like patent. Two years later he patented a process calling for the reduction of titaniferous ores in a bath of molten reducing metal, such as aluminum, in the electric furnace. In 1901 he procured a patent for the concentration of titanium in slag by the reduction of the silicon and iron of a titaniferous ore with carbon, the temperature of the operation being below the fusion point of titanium oxide. Many more patents have been secured by the Rossi interests in recent years.

An iron-titanium alloy is produced at one plant on a commercial scale in a Siemens electric furnace of 500-kw. size. Titaniferous ore, or slag, or rutile is introduced on top of a molten bath of scrap iron or steel. The reduction takes place in the arc, and the product is tapped off. According to Keeney the titaniferous ore charged has this analysis: 34.36% TiO_2; 50.53% FeO; 4.14% SiO_2; and 2.20% Al_2O_3. Slag from the process, if high in titanium, is recharged. The product obtained from the reduction analyzes 10 to 15% titanium; 5 to 8% carbon, and 0.35 to 1% silicon. If this alloy is refined, rutile being employed as a decarbonizing agent, a product is secured analyzing 10 to 15% titanium, 0.35 to 1% silicon, and less than 1% carbon.

Use of Lime to Reduce Titanium Loss

In order to reduce the amount of titanium lost through volatilization, Rossi in a late patent calls for the introduction of lime, CaO, on the molten iron bath, following this with titanic oxide, lime and carbon. This causes a reaction with the metallic titanium according to the following equation which is familiar to all students of this problem:

$$TiO_2 + CaO + 5C = Ti + CaC_2 + 3CO$$

In the Goldschmidt process the metallic oxides, which are to be reduced, are mixed with aluminum in the proper amounts, both oxides and the metal being in a finely powdered state. Ignition with a fuse brings some point of the mixture to the temperature at which aluminum and oxygen combine. Once started, the reaction proceeds to completion with the simultaneous reduction of the oxides.

High Aluminum Cost in Goldschmidt Process

The high cost of aluminum powder and the difficulty of securing a pure product are objections to the process. The reaction which takes place is according to

$$3TiO_2 + 4Al = 3Ti + 2Al_2O_3$$

The reaction may be started over a molten iron bath by the heat thereof. The product given by the Goldschmidt thermit process contains from 5 to 6% aluminum alloyed with the titanium.

In a late United States patent granted to Hans Goldschmidt and O. Weil, Germany, assigned to the Goldschmidt Thermit Co., the methods of making alloys higher in titanium are stated. The purpose of these alloys is to provide a medium for adding a higher percentage of titanium to iron and steel baths, thereby

overcoming alleged objections to alloys of low-titanium content. These alloys contain 15 to 35% titanium and 1.5 to 3.5% aluminum, the remainder being iron. The aluminum lowers the melting point of titanium by combining therewith to form an aluminum-titanium alloy, the alloying qualification being thereby increased, so it is stated.

For some reason there has existed a considerable skepticism as to the influence exerted by titanium when used as an additive agent in iron and steel metallurgy. That titanium does not have a profound effect upon steels so treated is shown by the incontrovertible evidence brought out by actual experiment and that gleaned from the apparently trustworthy literature. In general it may be stated that the addition of titanium to steel exerts an important influence on its properties, and its use is to be recommended to steel makers who have regard for the quality of their product.

Titanium's Deoxidizing Power

In the form of one of its ferroalloys titanium is used rather widely at present, and its use bodes to increase although there has been some falling off in its employment for the treatment of bessemer-rail steel. As a final deoxidizer and denitrogenizer in the metallurgy of steel, it follows the usual treatment for these objects with ferromanganese, or spiegeleisen, and ferrosilicon. Leading metallurgists seem to agree that titanium achieves its remarkable results by reason of its strong deoxidizing powers, together with its effect of giving the slag sufficient fluidity to separate it completely from the metal. The presence of titanic oxide, TiO_2, lowers the fusion point of occluded slags in iron and steel, thereby imparting a fluidity which will account for their removal. The statement that occluded oxides and gases, such as Fe_2O_3, FeO, free oxygen and nitrogen, are undoubtedly the real causes of many of the difficulties of steel makers need scarcely be made. The intense affinity of oxygen and titanium is a sure means for completely deoxidizing a steel, the advantage of which calls for no comment. It has been proved that an ingot of steel containing only a little titanium is practically free from segregation. Bessemerized and Tropenas-converted steels are known to contain the largest amounts of occluded oxides and gases, with openhearth, crucible and electric-furnace steels following in the order named, the reason for this being in their mode of manufacture. Titanium has a strong chemical affinity for oxygen and will remove even traces of it from a bath which otherwise would not be affected by the ordinary deoxidizers. Its property of removing occluded oxidized substances by causing them to separate readily is unique. In removing nitrogen, titanium stands as one of the very few elements which unite with this inert gas. The fact that titanium lessens segregation should not be unexpected in view of the well-known influence of agents which deoxidize and thus quiet a wild metal.

Titanium seems to have but little direct effect upon the constitution or structure of steels. It is known to lower the position of the Ar_3 point but it exerts little influence upon the positions of Ar_2 or Ar_1. Steels containing high percentages of titanium exhibit normal pearlite under the microscope.

The modern method of employing titanium is to augment the incompleted cycle of deoxidation by using one of the iron-titanium alloys after the other deoxidizers have been added. The other deoxidizers may be added either in the furnace or in the ladle, but it is best to add the titanium in the ladle and to give sufficient time for the titanium to complete its scavenging action. Thus the ladle will be held for from 5 to 10 min. prior to pouring so that the entrained slag, which is thus made more fusible, may have time to rise to the surface. There is no opportunity for the bath to chill as the titanium reaction with oxygen is exothermic, giving rise to 215,000 calories. The amount of titanium alloy to be added is normally small and should be proportional according to the quantities of impurities present.

The titanium alloys are added preferably in the ladle of steel after tapping from the furnace but before the slag has commenced to run. For soft, mild steel an addition equivalent to 0.03% titanium is sufficient under normal conditions and, in general, larger amounts may effect increased benefits, but not always.

Titanium in Openhearth Work

In acid openhearth practice ferromanganese and ferrosilicon are added to the ladle as soon as the ladle bottom is covered with hot metal from the tap, as is normal American practice. The titanium addition follows then as soon as possible. As already stated, the titanium addition is to be made before the slag begins to run, otherwise it is difficult to force the alloy down through the layer of slag on top of the bath. The ladle is to be held for 5 to 10 min. so that the impurities scavenged out may have sufficient time to rise to the surface and join the slag. In the event that the titanium alloy is added in the furnace considerable care should be exercised to prevent its contact with the slag, and it should be quickly rabbled into the bath. Tapping of the heat should follow at once, as delay will defeat the object in view. In basic openhearth work it appears expedient to add about 75% of the ferromanganese in the furnace and the remainder in the ladle with the ferrosilicon. The titanium alloy should then be added to the ladle in the manner already described, proper precautions being observed.

Removal of Dissolved Oxygen

In the bessemer process the titanium alloy should be shoveled into the stream of metal as it is being poured into the ladle, the steel having been first recarburized in the converter prior to pouring, as is normal procedure. Since the titanium reacts with vigor with molten silicate slags, the alloy should be given a thorough stirring into the metal before the slag flow starts, otherwise much of it will be wasted and its effect lost. The ladle is held for from 3 to 5 min. before teeming so that the titanium may have time to complete its action and remove as much of the dissolved oxygen, nitrogen and entrained oxides and slag as possible.

Some writers state that the alloys should not be preheated before adding to an iron or steel bath, while others urge the necessity of heating them red hot before using. Practical experience shows that it does the work cold as well as hot, and the general tendency is toward cold use. Whether or not the alloys should be used in conjunction with aluminum has not been fully determined.

Of all the appliances used for the production of liquid steel, the electric furnace admittedly does give a thoroughly deoxidized metal. Whether or not the steel has been deoxidized in the furnace, it will be somewhat reoxidized on tapping into the ladle, and slag will also become entangled with it during this time. For electric-furnace practice, whether acid or basic, it is well to add the titanium alloy during the tapping of the steel into the ladle in the same way as in bessemer and openhearth work, and the ladle is held as usual. In crucible practice the best results have been secured by adding the alloy to the pots before they are removed from the furnace and allowing time for the reactions to take place before the contents of the crucible are poured.

Effect on Cast Iron

The effect of titanium on cast iron has been the subject of much discussion; not a great amount of data is at hand for the accurate solution of the question, but the probabilities are that the element has quite contradictory effects. This is presumed to arise from its varying action with the different impurities present. In an extensive paper, in 1912, before the American Institute of Mining Engineers, Bradley Stoughton recorded data pertinent to the effect of titanium on cast iron, and one particular point to be noted from his findings is that titanium unquestionably reduces the chill. This should not be totally unexpected in view of the action of the metal as a deoxidizer and denitrogenizer. The elements oxygen and sulphur (and probably nitrogen) are productive of chill, and titanium, by removing them, consequently removes their chilling action.

It appears on the whole that not much benefit can arise from using titanium in the metallurgy of iron, but recently its use has been recommended by Dr. Moldenke as worthy of employment for the removal of nitrogen and oxygen where special irons are to be produced. Some metallurgists held for a long time that titanium rendered cast iron tough, probably because the well-known pig iron of Upper Styria contains a small percentage of the element.

Time Allowance for Reactions

In iron-foundry practice, the usual method of employing titanium is to scatter a predetermined amount of a titanium alloy along the runner prior to tapping. Upon tapping, the titanium alloy is washed into the ladle with the stream of iron. As in steel practice, time should be allowed for the chemical reactions to complete themselves, so that the ladle should be held for about 3 min. before pouring. As in steel practice, care should also be taken that the alloy does not come into contact with the slag, as slag attacks the alloy with great avidity, thus destroying its function. Iron may also be treated in the ladle by adding the titanium alloy to the ladle before or during tapping. In small hand ladles it is an easy matter to stir the iron with a rod in order to thoroughly incorporate the alloy. For usual deoxidizing purposes, about 2 to 4 lb. of a 15% alloy per ton of iron proves satisfactory.

L. Treuheit experimented with the effect of additions of 10 to 15% titanium and 25% titanium alloys on iron and arrived at the conclusion that the benefit derived from their use is small. The chief, and seemingly the only, value of titanium in the treatment of iron lies in its ability to deoxidize the metal. The element undoubtedly scavenges from the product of the cupola or air-furnace oxides and occluded gases, as well as nitrides. On this basis a certain given amount of titanium will cleanse any given iron; any less will be insufficient, while any more will not make the iron better.

Experiments by Dr. Moldenke show that the addition of titanium is beneficial in the case of gray iron, but that larger additions do not result in any additional benefit. Only a small advantage appears to have been secured in treating white irons with the element. Dr. Moldenke insists that the titanium addition is of advantage if no more is used than is required for the purpose of deoxidation. The use of iron-titanium alloy in the production of white iron for conversion into malleable castings, however, is considered to be still in the experimental stage.

Practice at the Mt. Champion Mill

By L. P. Weld*

The mill of the Mt. Champion Mining Co. is situated about 18 miles southwest of Leadville, Colo., at an elevation of 12,000 ft. It is connected by aërial tramway with the mine, which is at over 13,000 ft. elevation. Deep snow, scarcity of water and difficulties of freighting in supplies make winter operation hard at these altitudes. During the winter of 1915, however, the mill ran steadily, with only one shutdown, lasting a week, which was due to the blowing over of one of the tramway towers by an unusually severe storm.

The mine produces both low- and high-grade ore. The latter is freighted direct to the smeltery, likewise the mill concentrates, only the low-grade ore being milled. The principal value in the ore is gold, with a little lead and silver. The mill heads are extremely variable, making close extraction difficult. During one month the assay fluctuated from 0.16 to 0.62 oz. Au per ton. Of the total recovery about 70% is by amalgamation and 30% by concentration. The ore yields about 4% of iron-pyrite concentrates running from $60 to $90 per ton. The gold seems to be associated with the lead, for as the latter increases in the ore and concentrates the gold in the concentrates also increases.

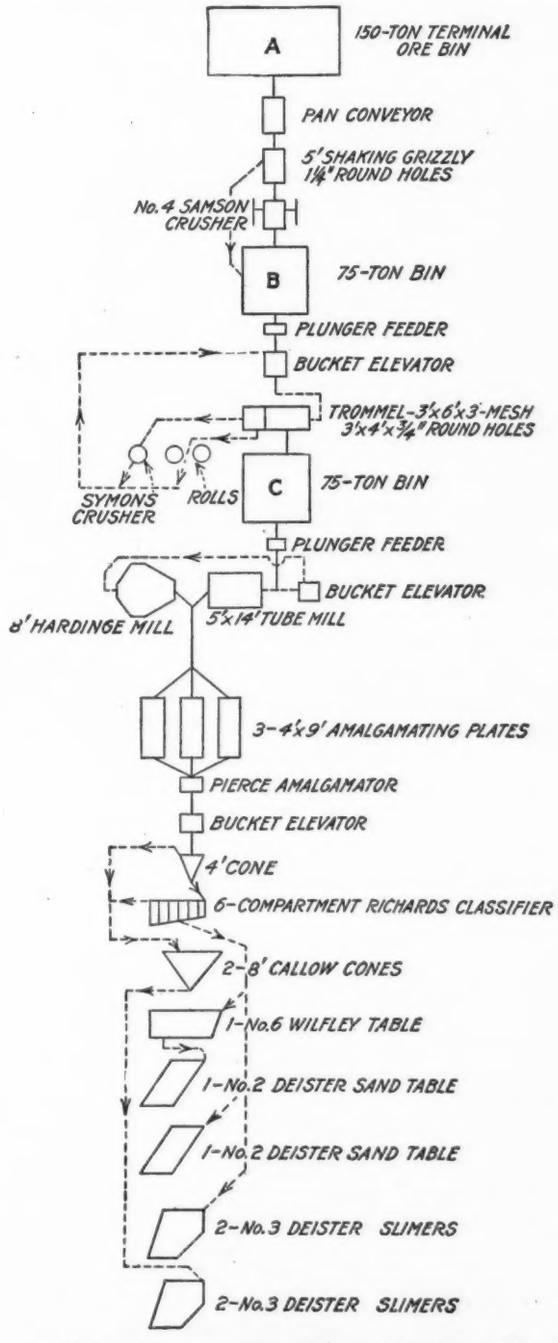
The system of milling is simple, as will be seen in the accompanying flow sheet. Coarse crushing is accomplished by a No. 4 Samson jaw crusher. Intermediate crushing is done in a 24-in. Symons disk crusher and a 24 x 14-in. set of rolls. The Symons crusher and rolls are in closed circuit with a trommel, only the —3 mesh going to bin C. Both coarse and intermediate crushing are looked after by one man per shift. After running the Samson crusher until bin B is full he shuts it down and starts up the Symons crusher and rolls, running these until C is full. Three hours' run with the Samson crusher and four hours with the Symons crusher keep both bins supplied all the time.

Final crushing is effected by a 5 x 14-in. tire-type tube mill and an 8-ft. Hardinge ball mill. The discharge ends are adjacent, and the discharged pulp flows over three amalgamating units. Each unit consists of two 4 x 4 ft.-6-in. plates, making a total plate area of 108 sq.ft. The

*Box 494, Lead, S. D.; formerly head amalgamator, Mt. Champion Mining Co., Leadville, Colorado.

plates have a grade of 2¼ in. per ft. which in my estimation is insufficient. The heavy sulphides build up unduly on them and necessitate too thin a pulp and additional wash water to keep them clear. After leaving the plates the pulp passes to a Pierce amalgamator and is then elevated to a six-compartment Richards pulsator classifier, followed by two 8-ft. Callow cones.

Concentration is made upon one No. 6 Wilfley table, two No. 2 Deister sand tables and four No. 3 Deister



FLOW SHEET OF THE MT. CHAMPION MILL

slimers. Middlings from the Wilfley are retreated upon the first Deister sand table. The tails flow to a 20 x 6-ft. Dorr thickener, which is in a separate building, and a 4 x 6-in. triplex pump returns the overflow to a 6 x 6-in. auxiliary mill-storage tank. The main water supply is from a small creek below the mill, and a 5 x 8-in. triplex pump throws the water into a 7 x 8-ft. mill tank.

Motors are all of a 440-volt, 60-cycle, alternating-current type, as follows: Samson crusher, shaking grizzly and elevator, one 25-hp. motor; trommel, rolls and Symons disk crusher, one 35-hp. motor; tube mill, one 50-hp. motor; Hardinge ball mill, one 50-hp. motor; seven tables and two elevators, one 15-hp. motor; one 5 x 8-in. and one 4 x 6-in. triplex pump, one 15-hp. motor; one 20 x 6-ft. Dorr thickener, one 7.5-hp. motor. There are thus seven motors in all, having a total of 197.5 horsepower.

One feature, although it is not a new one, is worth mention. This is the use of commercial sal ammoniac upon the plates after the morning cleanup. A small quantity, not over 10 grams, is sprinkled over each plate which is rubbed vigorously with whisk brooms; plates are then washed off with a hose and dressed with quicksilver in the usual manner. Before the introduction of the ammonium chloride, potassium cyanide had been used, and the plates were hard, discolored and nearly bare in spots. Recovery was very low. After the introduction of the chloride, plates quickly assumed a clear mirror-like surface, and recovery increased over 200% on the same grade of ore.

The mill has a capacity of 80 tons per 24 hours and regularly has a crew of 11 men, as follows: One foreman, one amalgamator, three table men, three crusher men, one tramway terminal man, and two roustabouts.

Ray Consolidated Quarterly Report

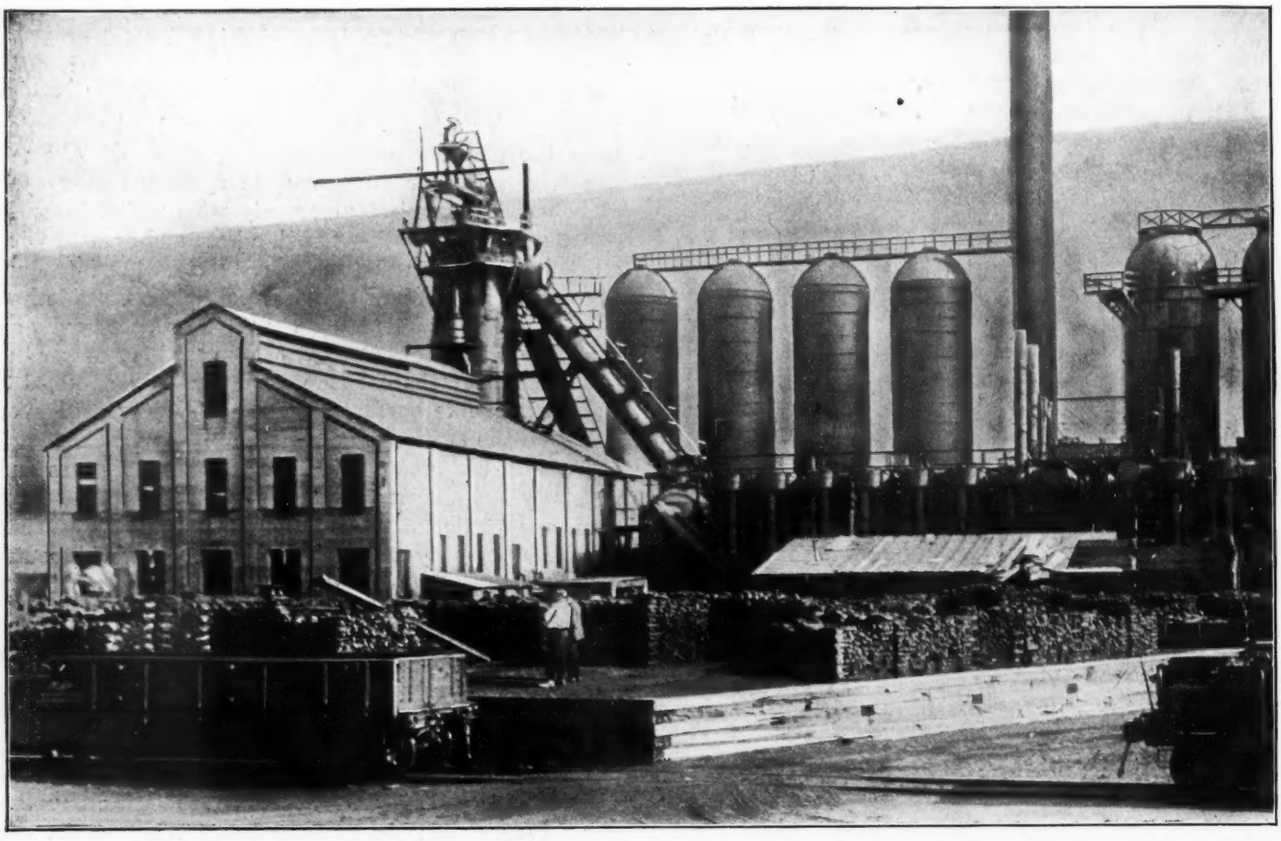
The report for the quarter ended Sept. 30 of the Ray Consolidated Copper Co. shows a gross production of 21,656,342 lb. of copper, as compared with 22,255,598 lb. in the previous quarter. The monthly production was: July, 7,398,500 lb.; August, 7,281,694 lb.; September, 6,976,058 lb.; the average being 7,218,781 lb. per month.

In addition to the copper obtained from concentrating ores, there was a total of 1,315,814 lb. from ores sent direct to the smeltery. This, combined with the copper in the concentrates, brings the total gross production for the quarter up to 22,972,156 lb., as compared with 23,532,119 lb. for the previous quarter.

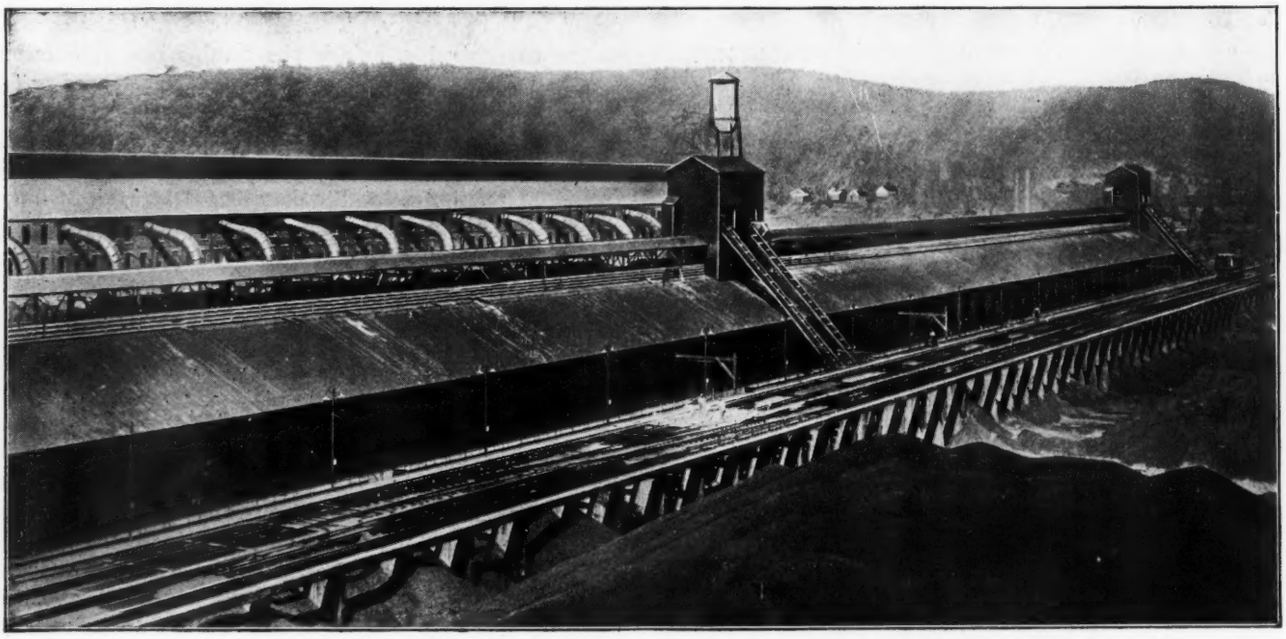
During the quarter there was milled 901,300 dry tons, averaging 1.629%. The underground development was 16,159 ft., making a total to date of 624,555 ft. Milling cost was 88.46c. per ton, comparing with 74.69c. for the previous quarter. The average mining cost of ore milled was reported as $1.16898 per ton, of which 5.163c. was the cost of coarse crushing, leaving the net mining cost $1.11735 per ton, as compared with a net cost of 98.257c. for the previous quarter. The higher unit costs are due to higher wages, the increase in cost of supplies and higher state and Federal taxes.

The average cost per pound of all net copper produced is given in the report as 12.795c., compared with a cost of 11.272c. for the previous quarter, and includes a charge of 12.5c. per ton of ore milled, for the retirement of mine development expense and credits to operating costs of dividends from the Ray & Gila Valley railroad, gold and silver produced and all miscellaneous income. A Red Cross dividend of 20c. per share was paid July 25 and on Sept. 30 the regular quarterly distribution of $1 was declared.

The New Jersey Zinc Company's East



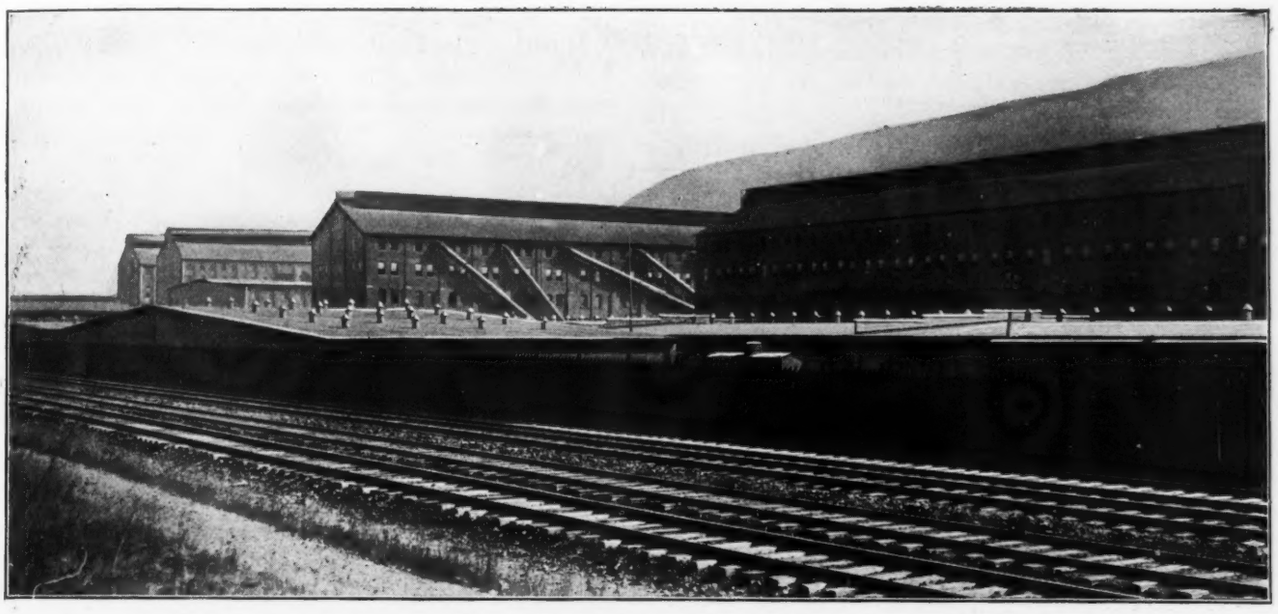
SPIEGEL DEPARTMENT OF THE NEW JERSEY ZINC CO.'S WORKS AT PALMERTON, PENN.



FURNACE BUILDING OF THE EAST PLANT OF THE NEW JERSEY ZINC CO.

At its two great plants, the East and West, at Palmerton, Penn., The New Jersey Zinc Co. produces zinc oxide, spelter, spiegeleisen, and a variety of byproducts. The main source of the raw material is the mine of the company at Franklin Furnace, N. J., the ore of which is separated magnetically into one product that is essentially willemite and another product that is mainly franklinite

and West Plants at Palmerton, Penn.



GENERAL VIEW OF BAG ROOMS OF OXIDE DEPARTMENT, WEST PLANT, PALMERTON, PENN.

DISTILLATION FURNACES AT PALMERTON, PENN., SHOWING OPERATION OF METAL DRAWING

Foreign Trade in Copper

Exports of copper from the United States in July, August, 1917, and the first eight months of the year, are reported by the Department of Commerce as follows:

	July Lb.	Aug. Lb.	Jan.-Aug. Lb.
Ore and concentrates, contents	293,200	351,420	3,855,808
Unrefined, in bars, pigs, etc	277,980	.....	4,146,799
Refined, bars, etc	54,275,337	95,733,812	728,828,592
Old and scrap	2,240	29,752	885,387
Plates and sheets	2,302,153	1,642,529	21,117,561
Pipes and tubes	2,782,255	2,289,320	a5,071,575
Wire	1,773,447	1,425,638	18,331,240
Composition metal, copper chief value	7	8,400	a8,407
Total	61,726,919	101,480,871	782,536,360

a Figures cover period beginning July 1.

The weight of ore exported in August was 4910 tons; no concentrates.

Imports of copper in July, August and the first eight months of 1917 were as follows:

	July Lb.	Aug. Lb.	Jan.-Aug. Lb.
Ore and concentrates, contents	8,686,134	11,814,430	98,368,249
Matte and regulus, etc	797,982	1,632,918	12,890,760
Unrefined, in bars, pigs, etc	10,122,230	34,546,504	249,753,857
Refined, in bars, etc	46,865	1,395,268	5,404,868
Old, etc., for remanufacture	2,488,410	464,068	15,263,845
Composition metal, copper chief value	492,092	161,376	353,075
Total	22,633,713	50,014,564	382,034,654

Importation in August, 34,043 tons ore, 18,158 tons concentrates and 1668 tons matte and regulus, etc.

Ore-Dressing Engineer To Be Appointed at Lake Superior Station

An open competitive examination for ore-dressing engineer is announced by the U. S. Civil Service Commission to fill a vacancy in the U. S. Bureau of Mines, at the Lake Superior station, Minneapolis, Minn. The salary ranges from $2400 to $3600 a year, depending on qualifications. The duties of the appointee will be to conduct investigations having for their object improving conditions in ore-dressing and metallurgical operations of the district, especially with a view to preventing unnecessary waste of resources, the beneficiation of low-grade iron ores, the utilization of manganese ores, especially those high in phosphorus, and otherwise contributing to the advancement of these industries.

Competitors will not be required to report for examination at any place, but will be rated on the following subjects, which will have the relative weights indicated, on a scale of 100: (1) Education, 30; (2) professional experience, 50; (3) publications, reports, or thesis (to be submitted with application), 20. Applicants must have been graduated in a course in mining engineering or metallurgy in a college or university of recognized standing, and have had at least five years of responsible experience in mining engineering, two years of which must have been in connection with ore-dressing operations. Applicants must be under 50 years of age on the date of examination and must submit with their applications their photographs, taken within two years.

The examination is open to all male citizens of the United States who meet the requirements. Applicants should at once apply for Form 2118, stating the title of the examination desired, to the Civil Service Commission, Washington, D. C.; the secretary of the U. S. Civil Service Board, Customhouse, Boston, Mass., New York, N. Y., New Orleans, La., Honolulu, Hawaii; Post Office, Philadelphia, Penn., Atlanta, Ga., Cincinnati, Ohio, Chicago, Ill., St. Paul, Minn., Seattle, Wash., San Francisco, Calif., and Old Customhouse, St. Louis, Mo. Applications must be filed by Dec. 18, 1917, with the Commission at Washington.

Foreign Trade in Lead and Zinc

Imports of lead and zinc during July, August and the first eight months of 1917 are reported by the Department of Commerce as follows:

Articles and Countries	July Contents, Lb.	August Contents, Lb.	Jan.-Aug. Contents, Lb.
Lead Ore:			
Canada	317,759	.....	7,972,527
Salvador	1,700	.....	3,117
Mexico	1,092,526	748,462	11,363,214
Chile	.....	.....	1,194,749
Peru	149,569	.....	348,072
Italy	.....	.....	46,719
England	8,528,583	.....	8,609,804
German Africa	.....	.....	4,405,145
France	55,410	.....	120,102
Panama	6,084	.....	6,084
Others	.....	.....	2,491
	10,151,631	748,462	34,072,024
Lead—Base Bullion and Bullion:			
Dutch East Indies	.....	505,064	607,938
Peru	8,730	.....	50,385
Canada	.....	.....	1,165,931
Mexico	6,214,098	13,046,929	52,465,111
	6,222,828	13,551,993	54,289,365
Lead—Pigs, Bars, etc.:			
Panama	3,710	14,688	60,138
Barbados	.....	.....	2,814
Colombia	.....	.....	3,155
Haiti	1,000	211	38,713
Canada	10,024	2,632	330,414
Guatemala	.....	.....	52,400
England	.....	.....	80,188
Mexico	.....	1,221,930	3,509,739
Peru	.....	8,936	18,948
France	.....	.....	89,086
Chile	.....	.....	8,769
British West Indies	13,446	13,867	27,313
Others	3,832	.....	7,086
	32,012	1,262,264	4,228,763

The gross weight of lead ore imported in July was 10,260 long tons, and in August, 5136 long tons. The actual tonnage of zinc ore imported in July and August amounted to 13,767 and 15,876 tons, respectively. The countries of origin and the metal contents were as follows:

Countries:	July Contents, Lb.	August Contents, Lb.	Jan.-Aug. Contents, Lb.
Canada	878,962	1,672,827	6,426,789
Australia	.....	.....	23,427,162
Mexico	6,531,129	8,343,275	72,077,660
Spain	.....	.....	12,166,840
French Africa	.....	.....	1,245,000
Italy	2,822,400	2,000,000	4,822,400
	10,232,491	12,016,102	120,165,051
Zinc in Blocks, Pigs, etc.:			
Costa Rica	783	.....	7,003
Panama	1,688	4,281	28,774
Cuba	31,913	12,817	246,752
Mexico	.....	.....	3,318
Ecuador	.....	.....	7,580
Canada	.....	14,619	31,805
Brazil	.....	.....	5,513
Colombia	.....	.....	6,000
Jamaica	2,165	.....	2,165
Others	274	2,273	4,035
	36,823	33,990	342,945

Imports of zinc dust amounted to 92,796 lb. in July, 135,714 lb. in August, 1917, and to 645,347 lb. during the first eight months. Of the August imports, 470 lb. came from Panama and 135,244 lb. from Japan.

Exports of lead and zinc were as follows (in pounds):

Lead:	July Contents	August Contents	Jan.-Aug. Contents
Pigs, bars, etc., produced from domestic ore	6,270,671	3,810,021	68,513,475
Pigs, bars, etc., produced from foreign ore	179,369	178,301	12,242,959
Zinc:			
Pigs, etc., produced from domestic ore	15,289,279	18,322,974	208,068,206
Pigs, etc., produced from foreign ore	4,480,007	1,515,071	66,772,084
Sheets, etc	2,436,590	4,242,651	19,422,955

Correspondence and Discussion

War Taxes on Mining Companies

In the letter on this subject by T. O. McGrath, published in the *Journal* of Nov. 17, he falls into two errors. In the first place he fails to either read, or rather to quote, all of the provisions in the circular letter, T. D. 2446, issued from the Office of Commissioner of Internal Revenue, Treasury Department, dated Feb. 7, 1917. The last sentence in paragraph 2020 says:

> The value contemplated herein as the basis for depletion deductions, authorized by this title, must not be based upon the assumed salable value of the output under current operative conditions less cost of production, for the reason that the value under such conditions would comprehend the earning capacity of the property.

Paragraph 2021 continues:

> Neither must the value determined as of Mar. 1, 1913, be speculative, but must be determined upon the basis of the salable value *en bloc* as of that date, of the entire deposit of minerals contained in the property owned, exclusive of the improvements and development work; that is, the price at which the natural deposits or mineral property as an entirety in its then condition could have been disposed of for cash or its equivalent.

After having determined this value *en bloc*, paragraph 2022 goes on to say:

> The value *en bloc* having been thus ascertained, an estimate of the number of units (tons, pounds, etc.) should be made. The *en bloc* value divided by the estimated number of units in the mine or mining property will determine the per unit value, which, multiplied by the number of units mined and sold during any one year, will determine the sum which will constitute an allowable deduction from the gross income of that year on account of depletion.

Paragraph 2024 states:

> The precise detailed manner in which the estimated fair market value of mineral deposits as of Mar. 1, 1913, shall be made must naturally be determined by each individual or corporation interested, and who is the owner thereof, upon such basis as must not comprehend any operating profits, the estimate in all cases to be subject to the approval of the Commissioner of Internal Revenue.

It is difficult to reconcile the statements in paragraph 2020 and paragraph 2024 unless one may leave out the words "based upon" in paragraph 2020, which would then indicate that the value cannot be arrived at by subtraction.

Tentatively my solution of the problem of the *en bloc* value of the property as of Mar. 1, 1913, would be by the application of one of Hoover's factors. Take the supposed mine to which Mr. McGrath refers and which he says on Mar. 1, 1913, has 1,000,000 tons of 5% ore. In it he assumes the net operating costs per pound as 10c., and the market price of copper 15c. In this case, however, he has not given all the factors. The value of that ore in the ground certainly is not $5,000,000, because it cannot be taken out in a day, nor is there anything to indicate that a plant is erected for the purpose of converting the copper in the ore into merchantable form.

Therefore, add to Mr. McGrath's factors the following: An ultimate yield of 90% of the copper contained in the ore is to be expected, or 90 lb. per ton; the mine has a plant erected worth $750,000 for the purpose of treating the ore, and the ore can be exhausted in 10 years. Under these assumptions the mine will treat 100,000 tons of ore a year and will produce 9,000,000 lb. of copper at a profit of 5c. per lb., or a gross annual profit of $450,000.

If it be assumed that the purchaser of the mine is satisfied with 7% net on his investment, and can invest a sum annually at 4% to return him his capital, then according to Hoover's tables the present value of an annual dividend of $1 over 10 years at 7%, and replacing capital by an investment of an annual sum at 4%, is $6.52. Multiplying $450,000 by 6.52, the then value of the property, as equipped, is shown to be $2,934,000. To ascertain the value of the ore there must be deducted from this the value of the plant, which has been placed at $750,000, thus leaving the *en bloc* value of the ore as of Mar. 1, 1913, as $2,184,000. To determine then the unit value as per paragraph 2022, divide by 1,000,000, giving $2.184 as the unit value of a ton of ore, or, expressed in terms of copper, 2.247c. per pound.

Whether the above calculation will meet with the approval of the Treasury Department it is hard to say, but in my opinion it is as close as one can follow the department's very conflicting statements.

New York, Nov. 20, 1917. J. PARKE CHANNING.

Put the Water Power to Work!

The great war in which our nation is engaged will be won not alone by food and men, but by mechanical power as well. Without mechanical power we could not make or move the weapons with which we fight—guns, ammunition, ships, and supplies. Our national resources of power, whether from coal, oil, or water power, are national war necessities. We need them to win the war. In this gigantic struggle our security requires us to use all these great resources, and to use them wisely and well.

The people of the United States own about fifty million undeveloped water horsepower, or about enough to run every train, trolley, factory, mill, mine, and electric power plant we have. For ten years the friends of conservation have urged the development of public water powers in the public interest. But development has been held back by a little group of water-power magnates and their friends in Congress, who have blocked all legislation which would not give them these valuable properties forever and for nothing. Today, when the nation needs all its resources, the same men who have been blocking reasonable water-power legislation own and are holding millions of water horsepower, undeveloped and out of use, while clamoring for more.

The time has come when such obstruction threatens the nation's safety and success. We need the development of these powers in war even more than in peace.

At the coming session of Congress sound water-power legislation should be enacted as a war measure, based upon principles fair to all sides. These principles I believe to be briefly as follows:

(1) The thing to do with water power is to develop it. Whatever retards or restricts the development of public water powers on terms fair to the public is against public policy and hostile to the general welfare. (2) Water power belongs to the people. The sites where it is produced should always be held in public hands, for only so can effective control in the general interest be secured. (3) Where public development is not desired, the right to use water-power sites should be leased for periods long enough to permit sound, attractive, and profitable investment, but never longer than 50 years. At the end of each lease all rights should return to the people who gave them. (4) In order to protect the consumer against extortion, rates and service should be regulated by Federal authority when state or local authorities fail to do so. (5) Reasonably prompt and complete development and continuous operation, subject to market conditions, should be required. Already millions of water horsepower are held out of use to further monopoly by private corporations. (6) Corporations or individuals who make money out of rights granted by the people should share their profits with the people. (7) The public has a right to complete information about every business based on the use of public property.

These are the principles for which the friends of conservation have been contending. Many water-power men believe them to be fair and sound. They will, I hope, commend themselves to the *Journal* as wise and reasonable. I am writing to ask support for immediate legislation, based upon them, when Congress meets. This is no time to give away public assets necessary for the welfare of our people both in the war and after the war, and we should no longer tolerate the selfishness of private interests which take the dog-in-the-manger position that they must have these water powers on their own terms, or no one shall use them at all.

As the President has said: "The supreme test of the nation has come. We must all speak, act, and serve together." GIFFORD PINCHOT.

Milford, Penn., Nov. 12, 1917.

Rights of a Miner Who Resumes Work on Abandoned Claim

To decide a good-natured argument, will the *Journal* please publish the answer to the following question: *A* locates a claim and does work on it as required by law. For various reasons he abandons it. Several years later he returns to the same ground, and, finding no intervening rights, resumes work without locating again. He opens an orebody, whereupon *B* then covers the claim with a new location and claims the ground. Whose rights are valid? SUBSCRIBERS.

Salt Lake City, Utah, Oct. 4, 1917.

[The apparent difficulty in this case lies in the matter of abandonment. The courts have held consistently that abandonment involves intention and that the burden of proof rests with the party who asserts that a claim was abandoned. A peculiar analogy may serve to emphasize this point. A mother leaves her infant in a field, with intent to abandon it, and goes to some other locality to work. She thinks of the child as a weakling, or unattractive, or a nuisance, but after a lapse of time she goes back and finds the child. Others may have seen it, but no one has taken any action to alter the status of the child or of her relation to it. She nurses the child and continues as if nothing had happened, having reconsidered her decision to abandon it. If the child thrives, any stranger who had observed the infant in the field and had passed by without taking any action would find it a hard task to convince a court that the child had been abandoned and should be surrendered to the claimant offering to adopt.

Forfeiture of rights in a mining claim, however, involves the question of whether the locator has complied with the law. But forfeiture does not become an accomplished fact until a third party has intervened. If it becomes a matter of public knowledge that a claim has been abandoned, or if for any other reason it becomes lawfully subject to forfeiture, the ground is open to location by another, in the same manner as if no location of the same had ever been made. When forfeiture is once established, the original locator has no further legal standing in connection with the ground in question.

In the case propounded it is clear that forfeiture was never made effective. The mining law stipulates that upon failure to comply with the required conditions, the claim shall be open to location, "provided that the original locators, their heirs, assigns, or legal representatives, have not resumed work upon the claim after failure and before such location." In commenting on this phase of mining law Lindley[1] cites, among others, the case of Belk vs. Meagher:

> *A* located in 1864, and the location was valid and subsisting when the act of May 10, 1872, was passed. No work was performed, however, after that date until June, 1875, when *A* resumed work upon the claims and *did enough to reëstablish his original rights*. *B* attempted to relocate on Dec. 19, 1876. It was held that *A's* resumption protected the claim from relocation until Jan. 1, 1877. There could be no forfeiture until that date. *B's* relocation was therefore void and did not take effect on Jan. 1, 1877, although *A* failed to perform any work during the year 1876.

In the case propounded, if *A* made no public record of abandonment and worked continuously after resumption of work, *A's* rights are valid. If *A* did make a formal declaration of abandonment, then *B's* rights are valid or he at least has a good chance in court. If *A* resumed work and stopped again before he had performed the labor making up one year's delinquency, and *B's* location was made after a reasonable period of time had elapsed since said stopping, then *B's* rights are valid. The validity of the "declaration of abandonment" and the duration of "a reasonable period of time" would be matters for a jury or a court to decide.—Editor.]

Release From Assessment Work

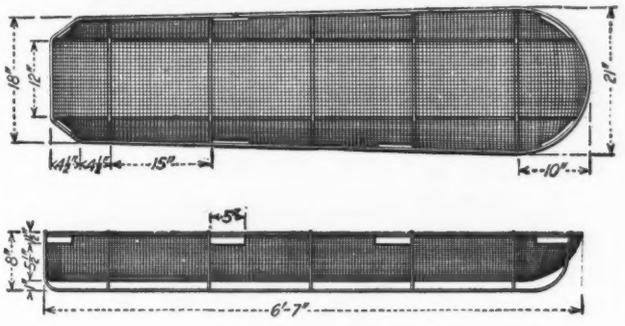
Referring to the article "Release from Assessment Work," in the *Journal* of Nov. 17, I should like to know if claimholders can obtain patent on a mining claim on three years' work performed, and two years' tenor of claim, without work, under the recent act passed by Congress?

[1]Lindley on Mines, 1914, p. 1638.

Details of Practical Mining

Underground Basket Stretcher

A type of underground stretcher that has given good service on the Mesabi range and conforms to all requirements is shown in the accompanying sketch. A rigid frame is made of ½-in. half-round iron, riveted at the joints. The longitudinal supports are bent up at the ends and the lateral supports are U-shaped, varying from 18 in. at the lower end to 21 in. at the upper; their depth is 8 in. An oval-shaped retaining rod of ½-in. half-round iron serves as a brace for the supports and gives rigidity to the frame. Eight hand holes are provided so that the stretcher may be carried in a horizontal position. These are formed from ½-in. half-round iron riveted to the frame at the required points.

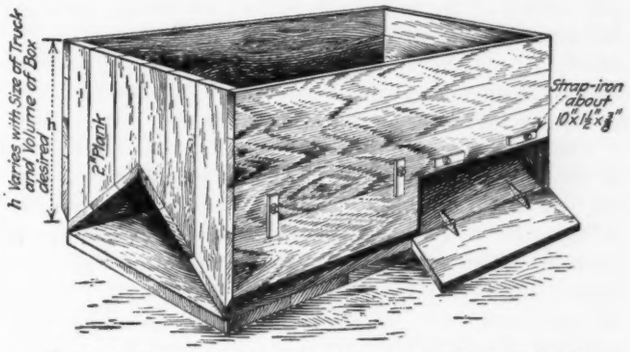


BASKET STRETCHER FOR UNDERGROUND USE

The frame is covered on the sides and bottom with wire screen of ⅜-in. mesh which is stretched tight, the edges being turned around the half-round iron. Eight ferrules of $\frac{3}{16}$-in. wire are provided and fastened to the frame at points so that leather straps may be used for either tying in or suspending the patient. Two straps are attached to the upper edge and these pass under the armpits. Farther down one strap is used across the chest. Two straps are suspended at the middle and are used for crotch support, and the lower strap serves to tie in the legs. The straps should be padded where they touch the patient and particularly at the points of suspension. The basket is of sufficient depth to permit the patient to lie comfortably when the stretcher is being carried horizontally, and the suspension can be evenly adjusted when in a vertical position.

Hopper-Bottom Truck Bodies Used for Rapid Unloading

Contractors who contemplate the use of removable hopper-bottom truck bodies, to secure rapid unloading of loose materials and ability to employ the truck on various services, will be interested in the side-dump boxes described by J. B. Rogers in *Engineering News-Record*. The scheme is shown in the accompanying sketch. One of the good points of this box is the bottom-hinged side door which falls down as soon as the catch button is released, and serves as an apron to throw the material clear of the wheels. Each side has a divided door, so that quadruple control of the dumping is

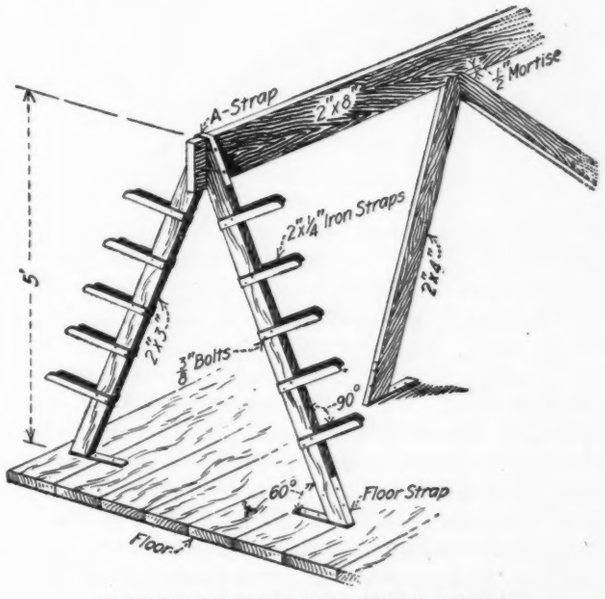


HOPPER-BOTTOM BODY THAT IS EASILY REMOVED

secured. The box ends are solid and with the inverted V-bottom make possible a rigid unit that can be easily put on and taken off the truck.

Rack for Sharpened Drill Steel

A simple and convenient rack for sharpened drill steel is shown in the accompanying illustration. It consists of a series of A-bents to the legs of which are bolted at 90° a series of iron straps in pairs. The legs



SECTION OF RACK FOR DRILL STEEL

are set at 60° to the floor of the shop, to which they are screwed firmly by means of 60° angle straps and meet at the apex on each side of a 2 x 8-in. board running "edge up" the whole length of the rack and to which both legs are firmly held by a 60° iron strap. To brace the rack longitudinally a 2 x 4-in. A-brace is mortised at the center of the apex board, the legs being strapped to the

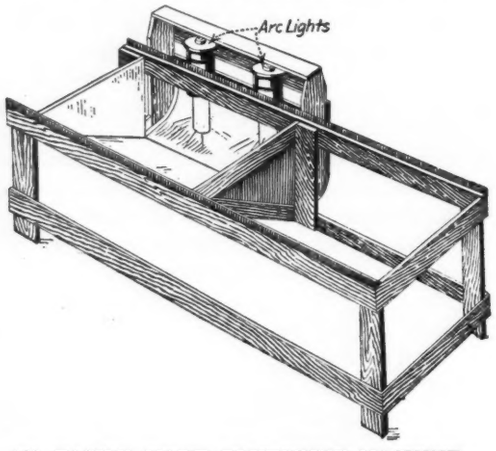
floor in a plane at 90° to the planes of the bents. Such a rack is in use in underground drill-sharpening shops in the Joplin district, where hollow steel drills up to 18- and 20-ft. lengths are employed. The various lengths are laid on the projecting straps between bents and can be readily sorted and made up into sets by the drillers; and inspection of bit and shank is readily made.

Blueprint Machine

Where blueprints are needed frequently, but there is not sufficient work to pay for an automatic printing machine, the one described by G. F. Wetzel, in *American Machinist*, of Nov. 15, 1917, will answer the purpose. Any carpenter can put it together, and the material needed is inexpensive and easy to obtain.

The machine frame is made of ¾ x 4-in. boards and is about 6 ft. 6 in. long, 27 in. wide and 36 in. high. On the upper edge of both front and back top strips is screwed a 1 x 1 x ⅛-in. angle, with vertical flange outward. This serves as a track for the printing frame, which has a small grooved pulley and shaft fastened on each side near the corner. A standard 24 x 36-in. printing frame is used.

One end of the machine frame contains the light well, which is 3 in. long and bounded on each end



AN EASILY MADE BLUEPRINT MACHINE

by a triangular sheet of aluminum, polished on one side, of about No. 16 gage, B. & S. A plate-glass mirror, approximately 30 x 32 in., slants down at 30 deg. from the top front member, and at the back is a sheet of aluminum. The light is furnished by two arc lamps, spaced about 15 in. on centers and in front of the rear reflector sheet. The lamps are supported by wooden braces, as shown in the figure. The rear reflector is bent at the bottom to come around and meet the lower edge of the mirror, where two pins in the frame engage in holes in the sheet. At the upper edge of the sheet two round holes, with radial short slots at the top, slip over two wood screws with round heads. Thus by raising the sheet it can be removed for access to the arc lamps. About an inch space is left around the rear sheet for ventilation.

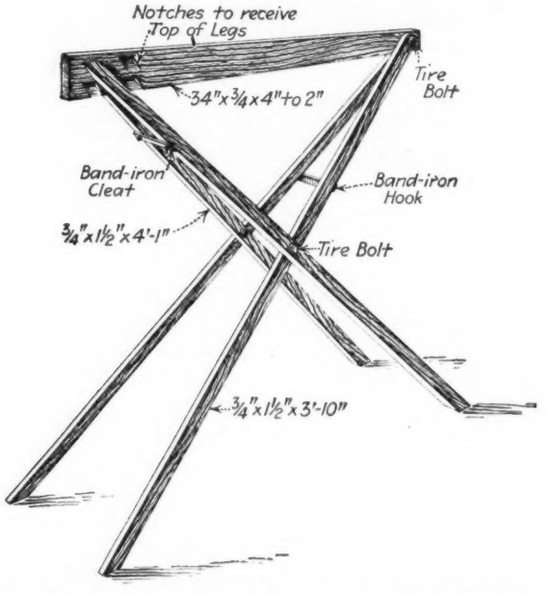
In using the outfit, the printing frame is in a horizontal position, with the glass side down, on the tracks. The felt pad and back are heavy enough to hold the tracing and paper flat. Ordinarily, the frame is left over the light well; but for wiping dust off the mirror or inspecting the lamps, it is pushed to one side. As the field of illumination is only 30 in. wide, when a longer print is desired expose only one half and then the other one by rolling the frame along. If larger prints than 30 in. are standard, three lamps will be needed.

Good, evenly colored prints can be made in about 5 min., using electric rapid blueprint paper, without moving the frame. In shops where this machine would fit in, ordinarily the draftsman can stop long enough to start the print, go back to his desk and then remove the print without interfering appreciably with his work.

Another way in which the machine can be used is tracing through sketches or prints. By removing the pad and back of the printing frame, the light will show through a heavy print or sketch made on drawing paper, so that it can be easily traced.

Folding Trestle for Drafting Table

A drawing table trestle which will take up a space only 4 in. square and 4 ft. long when stored would prove a great convenience to many engineers who do not need a drawing table continually, or whose work sometimes requires one where ordinarily there would not be proper facilities. According to H. A. Sitterley in *Engineering News-Record*, Sept. 27, 1917, the trestle in the accompanying drawing has been used for the last two



ADJUSTMENT FOR HEIGHT AND SLOPE OF BOARD EASILY MADE

years at the Low Moor Iron Co., of Virginia, and has proven to be convenient, rigid, light and capable of being easily transported and stored in a small space.

The following is a bill of necessary materials:

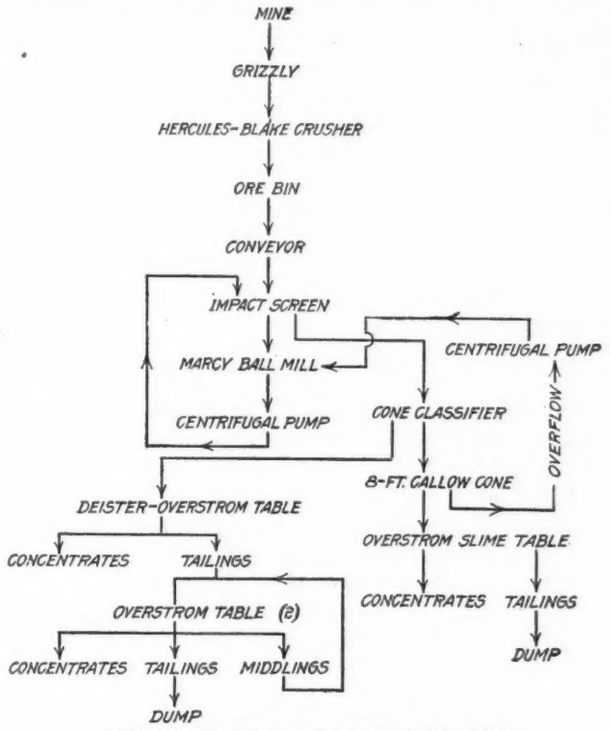
2—¾ x 1½-in. hardwood strips, 4 ft. 1 in. long, front legs.
2—¾ x 1½-in. hardwood strips, 3 ft. 10 in. long, back legs.
1—¾ x 4-in. hardwood board, 34 in. long, top piece.
6—1-in. shothead screws.
2—2-in. tire-bolts and washers.
1—2½-in. tire-bolt and washer.
1—¾-in. band-iron strip, 7 in. long, drilled for screws on 6-in. centers and one hole cut out to serve as a hook.
1—¾-in. band-iron strip, 4 in. long, drilled for screws on 3½-in. centers.

The method of assembling is perhaps sufficiently illustrated in the drawing. By placing the top ends of the longer legs in the different notches, in the top piece, the top of the trestle can be made either level or sloping, and the height adjusted from 34 to 42 inches.

Details of Milling and Smelting

Flow Sheet of Round Valley Tungsten Mill

The Round Valley Tungsten Co., of Bishop, Calif., is milling 100 tons of scheelite ore per day, using the accompanying flow sheet. The ore contains about 1%



CONCENTRATION OF TUNGSTEN ORE

WO_3 and the company is making 20 to 30 tons of 63 to 64% concentrates per month.

The mining is done by the gloryhole and shrinkage system, and the mill has been in operation since the middle of August. Cooper Shapley is general manager and H. C. Miller is superintendent. Shipments were begun about two months ago.

Babbitting Without a Mandrel*

BY W. F. SCHAPHORST

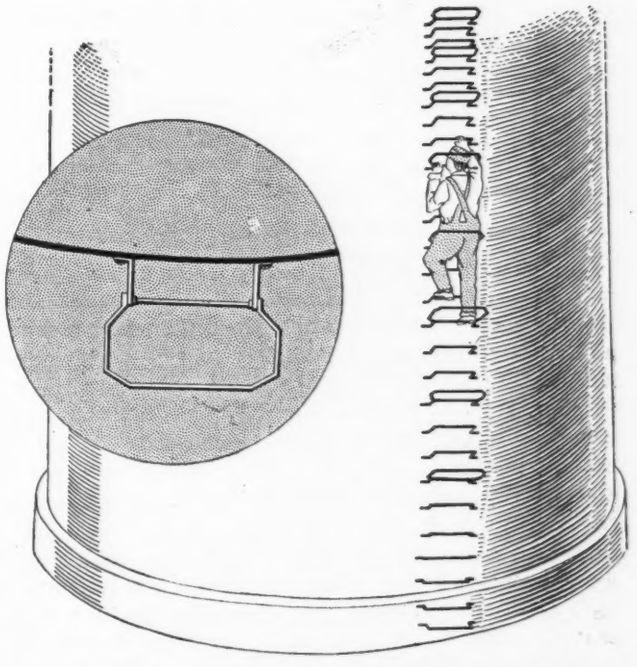
I once ridiculed the idea of using a special mandrel for babbitting bearings, and in most instances I am still against such practice, because in my experience I have never had a failure by using the shaft itself as a mandrel, pouring the babbitt directly around it. The way to do it properly is to do it quickly. Take all the time desired for preparing the moulds, and prepare them in such a way that the babbitt can be poured almost instantly. By pouring quickly, all sides of the shaft are heated simultaneously and expansion is the same all over. The danger that must be overcome is the danger of warping, which will occur when the babbitt is poured slowly and on one spot on the shaft. That spot becomes highly heated, expands, and springs the shaft in such a way that the hot spot will be on the convex side. Before the shaft can spring back, the babbitt solidifies and holds the shaft in a bent condition. Sometimes this bend is slight, so slight that the shaft can be turned any way, due to the clearance allowed, but the bend can be actually "felt" with the hand, because in one position it turns more easily than in any other.

To prepare the shaft for the mould it is a good plan to burn some oily waste and create an oily soot on the shaft. This soot serves a double purpose. It provides the necessary clearance medium, and it is a good insulator against heat. If the soot isn't thick enough, wrap a thickness or more of thin paper around the soot. This will make a double insulator. A string tied around the paper may be utilized to form oil grooves.

*Copyright, 1916, by W. F. Schaphorst, Woolworth Building, New York.

Safety Ladder for Smoke-Stacks

Ladders built on the outside of smoke-stacks have little attraction for the fellow who has to climb them occasionally. The man who has climbed an ordinary ladder



LADDER PROVIDED WITH SAFETY GUARDS

to the point where he keenly realizes that his "dear life" depends entirely on his muscles, and has then climbed on to the point where he realizes that his muscles are failing and quivering from sheer exhaus-

tion appreciates the value of a ladder inclosed in guards, the description of which is given by H. B. McDermid in a recent issue of *Power*. It is almost impossible to fall from this ladder, as the enveloping hoops or guards are not more than three feet apart, so at no time is a man's body entirely devoid of protection. The hoops are large enough to give plenty of clearance when climbing, yet small enough so that one can lean back against them in perfect safety while resting hands and arms. A fall from such a ladder is practically an impossibility.

Use of Building Paper in Merrill Presses

BY R. WHEELER*

The frames of the Merrill triangular precipitation presses are generally covered with canvas and a light, cheap twill—the latter being removed and burned, or dissolved in the sulphuric-acid treatment, to recover any precipitate on it. With the increasing cost of cloths during these times a lower priced and efficient substitute was sought. The practice of the Alaska-Treadwell company of putting a filter paper next to the twill was adopted. At Hedley, B. C., one sheet of unglazed building paper of good grade is used next to the twill. The cost of the paper sheets is not over 2c. a piece, while the cost of the twill is from 17.5 to 22.5c. The twills will last several months when thus protected by the building paper.

At each cleanup, the paper with all the precipitate clinging to it drops into a cloth suspended under the entire length of the press and above a tray for added protection. The twills are left in place, clean and untouched. The cloth containing the precipitate and papers is removed to the acid vat where the contents are dumped into the vat and the cloth kept for future cleanups. When it becomes too rich with precipitate it is also placed in the acid vat to be dissolved. The method is clean, quick, and inexpensive where the acid treatment is used for zinc-dust precipitates.

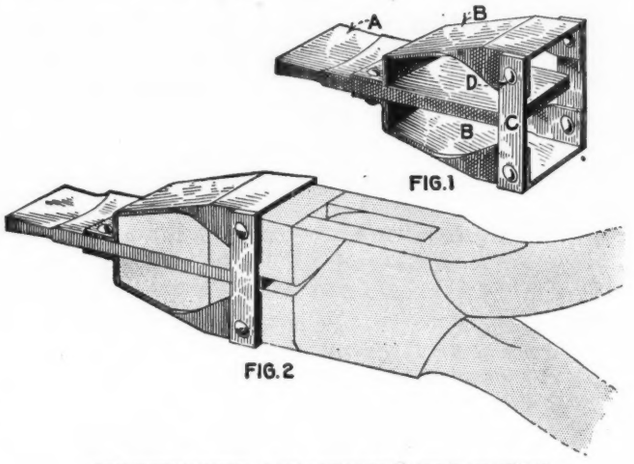
Treatment of Metallurgical Smoke in Japan†

Taking care of smelting smoke has long been an important problem for Japanese metallurgists. At the Hidachi copper works, according to Tetsurow Komakine, an aircraft (perhaps it is better to say a sack filled with hydrogen) was recently utilized to examine the air currents at great heights above the smelting plant, and is expected to furnish much needed data to aid in solving the smoke question. At present the smoke is ejected from a stack over 500 ft. high built on a mountain about 700 ft. above sea level. It has been found that the gases are not equally dispersed and that a great proportion may follow certain "channels," which vary from time to time. Mr. Komakine further states that the 1000-ft. stack projected for some time at this works is now being built with the idea of passing the gases out to sea before they fall. He adds that at the Ashio works, the Cottrell electrostatic process precipitates the solid particles in the smoke but that additional processes are being developed to catch or render the SO_2 harmless. Neutralization by lime has been practiced for years in Japan.

*Mill superintendent, Hedley Gold Mining Co., Hedley, B. C.
†"Met. and Chem. Eng.," Oct. 15, 1917.

Screwdriver Attachment for Use on Cutting Pliers

Since pliers and screwdrivers are the tools most frequently used by the electrician, they should be in such a form that they can be easily carried around. Pliers



SCREWDRIVER ATTACHMENT FOR PLIERS

with a screwdriver forged at the end of one of the handles are common, but the screwdriver is unhandy and is seldom used.

After considerable experimenting, the screwdriver attachment shown in the illustrations was developed and has proved very useful to me and to other workers who have made one, writes M. P. Bertrande in *Power*. In Fig. 1, *A* is made of tool-steel and hardened. The jaws *B* are bent from $\frac{1}{16}$-in. soft sheet iron and held together by the two straps *C* and rivets *D*. Dimensions cannot be given, as curves and shapes change in accordance with the shape of the pliers used. The form is obtained by bending the sheet iron around the pliers and riveting it to the tool-steel blade *A*. The device is so small that it can be easily carried in the vest pocket. Fig. 2 shows the screwdriver attachment in place ready for use.

Powdered Coal for Steam Plants

The composition of powdered coal used in heating and puddling furnaces must come within certain restrictions in order to be used successfully. C. J. Gadd, writing in the *Journal of the Franklin Institute*, says that coal for this purpose should not have less than 30 per cent. volatile matter, nor less than 50 per cent. fixed carbon. Its moisture should not exceed 1.25 per cent., its ash 9.50 per cent. and its sulphur 1 per cent. The requirements for openhearth furnaces are more rigid. The volatile content should be higher and not under 36 per cent. The fixed carbon should be at least 52 per cent. The moisture and sulphur may still be 1.25 and 1 per cent. respectively, but the ash must fall below 6 per cent. In powdered coal sulphur when present only in small quantities has no ill effect in heating and annealing furnaces, but it should be given careful attention when used in the reduction and refining of metals or ores.

Events and Economics of the War

The Italians are holding the Teutons at the Piave River, after flooding the approaches to Venice; Austrian detachments that succeeded in crossing have been driven back; an attempt to outflank the Italian line in the north is in progress. In Russia the Kerensky government has been defeated and Kerensky has disappeared; the Bolsheviki, though seemingly victorious, apparently lack wide popular support. In France, Clémenceau is again premier, after Painlevé's fall, and has picked a radical cabinet. In England, a storm of discussion has arisen over the question of centralized control of the war; the proposal to make Northcliffe air minister has caused Cowdray to quit the cabinet; the British have captured Jaffa in Palestine and, in a fight off Helgoland, crippled two German ships.

In this country, new rules for classifying drafted men have been issued by the War Department and all exemptions canceled. The labor convention at Buffalo has backed Gompers in voting to support the Government; railroad brotherhoods have assured the President that they will not strike. A board of excess-profit advisers has been created by Secretary McAdoo; the U. S. Bureau of Mines will be assisted by a board of chemists in all matters pertaining to explosives. Daniel Willard has been appointed chairman of the War Industries Board and Henry Ford has joined the staff of the Shipping Board as assistant to Charles Piez.

Coal Miners Accept to Penalty Clause

The recent decree of the Government assessing a penalty of $1 per day upon miners who refused to work, which was the cause of the abrupt ending of negotiations recently conducted in Washington between representatives of coal miners and operators of the Southwestern field and Dr. H. A. Garfield has been agreed to by the miners. The penalty was imposed by the Government as a war necessity when miners in the West and South walked out. The latter's representatives thereupon informed Dr. Garfield that the miners insisted upon the right to adjust their own working conditions. The Fuel Administrator maintained, however, that the penalty was just and necessary as a war measure and insisted that the clause be inserted in every contract between the operators and workmen. The miners' representatives thereupon quit the conference, first deciding to meet in Kansas City on Nov. 12. At this meeting they accepted the clause.

Wage increases sought by the Southwestern miners are based on increases agreed on recently by operators and union heads in the central competitive field. The central field contract contained provisions for automatic penalties and was approved by Dr. Garfield, who recommended to President Wilson the 45c. coal-price increase. Under the penalty provision miners who struck without cause would be fined $1 a day each and operators locking men out without cause would pay a fine of $2 a day for each man not working.

Excess Profits Advisers Appointed

The appointment of an advisory board of nine members to be known as the "excess profits advisers" has been announced by Secretary McAdoo. It will act as a board of appeals for the Internal Revenue Bureau on all questions connected with the interpretation and execution of the excess profits section of the new war-tax law.

The members of the board are: Representative Cordell Hull, a member of the House Committee on Ways and Means; T. S. Adams, economist of Yale University; Wallace D. Simmons, President of Simmons Hardware Co., St. Louis and Philadelphia; J. E. Sterrett of Price, Waterhouse & Co., accountants, New York; S. R. Bertron, of Bertron, Griscom & Co., bankers, New York; E. T. Meredith, editor *Successful Farming*, Des Moines, Iowa; T. W. McCullough, editor *Omaha Bee*, Omaha, Neb.; Stewart W. Cramer, of the National Council of Cotton Manufacturers, Charlotte, N. C., and Henry Walters, chairman of the board, Atlantic Coast Line, and Louisville & Nashville roads.

War-Savings Plan Summarized

The war-savings plan provided for in the last bond act, of Sept. 24, 1917, goes into operation on Dec. 3. Stamps, which are the Government's certificates of indebtedness, are to be sold in two denominations—thrift stamps, which will cost 25c. each, and war-savings stamps, costing from $4.12 to $4.23 each according to the month in which they are purchased. With the first thrift stamp the purchaser is given a thrift card with spaces for 16 stamps. When 16 thrift stamps have been purchased and affixed, the thrift card can be exchanged for a war-savings stamp by paying the difference between the $4 the thrift stamps represent and the current value of a war-savings stamp, which in December, 1917, and January, 1918, will be $4.12, and thereafter 1c. more for each succeeding month during the year 1918.

With the first war-savings stamp obtained by purchase or exchange the owner is given a war-savings certificate containing spaces for 20 war-savings stamps. If these are filled during December, 1917, or January, 1918, the cost to the purchaser will be $4.12 for each stamp, or $82.40 for the full certificate, and on Jan. 1, 1923, the Government will redeem the certificate at $100, giving the holder a net profit of $17.60 for the use of his money. Although these investments do not mature until Jan. 1, 1923, provision is made whereby upon 10 days' written notice after Jan. 1, 1918, such certificates will be redeemed by postmasters at their cost to the purchasers plus 1c. a month on each war-savings stamp on the certificate.

The thrift stamps do not bear interest, but the war-savings stamps bear 4%, compounded quarterly. The certificates will be dated Jan. 2, 1918, and mature Jan.

1, 1923. Under the plan an amount as small as 25c. can be invested in a Government security, and as soon as $4 has been thus invested an interest-bearing certificate of the United States Government can be secured. The stamps and certificates can be obtained from post offices, banks, or trust companies, at most railroad stations, stores, factories, and many other public places.

Outlook in Steel Industry

As the Government program of steel requirements develops, the steel consuming trade in various lines is feeling the first cleavage between essential and non-essential industries, says *Iron Age*. As priority rulings multiply, the disturbance from steel scarcity in certain minor lines increases and it becomes clearer that the list of affected businesses will grow. Inability of certain manufacturers to count on steel supply promises to figure more and more in the war toll. The automobile industry is much disturbed by the announcement that alloy steel will be largely withheld from it, yet there is nowhere any definite knowledge as to the amount of such steel Government needs will require.

Government shell steel now under inquiry amounts to 1,500,000 tons. The Government's requirements are counted on to be 100% of ship-plate output, after due allowance of plates for war and food industries and railroad upkeep. Many plate users must resort to universal plates and a larger use of rivets. For the destroyers for which contracts were recently let, 60,000 to 70,000 tons of steel has been given out, largely plates. A measure of the scarcity of plates is found in the estimate that Government merchant ships, representing entirely new demand, will take in each of the next two years 1,500,000 tons of plates. The total production of sheared plates, ¼ in. and thicker, was not quite 2,500,000 tons in 1916.

To Burn Toluol or To Shoot It

"When the spring drives of 1918 begin, American soldiers will be participants in great numbers. If they are to prove equal in effectiveness to our British allies, if their casualty lists are to be held down to relatively small numbers, they must be supplied with the maximum possible amount of high explosives for barrage fire.

"Of the several high explosives now in use, the War Department has pronounced tri-nitro-toluol (T.N.T.) as best," says Dr. Charles H. Herty, editor of the *Journal of Industrial and Engineering Chemistry*. "It is the easiest high explosive to make, and the safest to transport. For its manufacture toluol is required. At the present time there is produced annually approximately 11,000,000 gal. of toluol from byproduct retort coke ovens, which have increased rapidly in number since the war began. This quantity, however, is under contract for the supply of the Navy and the Allies. At least a year is required for the construction of a large battery of byproduct ovens. For the new army the only quickly available source of toluol is the gas plants. A statement to that effect was made recently by Brig. Gen. William H. Crozier, chief of the Bureau of Ordnance of the War Department. Gas plants can be equipped within three to four months, some more quickly, to remove the toluol from gas."

General Crozier further stated that the mobile artillery alone would require by September, 1918, at least 22,000,000 gal. of toluol. Statistics show that during 1916 approximately 220,000,000,000 cu.ft. of gas was produced in this country. Assuming an average recovery of 0.05 gal. of toluol per 1000 cu.ft. of gas, we should be producing from the gas plants within the next four months, if immediate steps are taken everywhere, at the rate of 11,000,000 gal. of toluol annually. Even at this, the recovery of toluol would amount to only half of the requirement for an army of a million men. It is possible, however, by a more complete stripping of gas, to increase the yield beyond 0.05 gal. per 1000 cu.ft., thus more nearly meeting the requirements.

Each day's delay means a sacrifice of T. N. T. sufficient for 150,000 3-in. shells. Is it not time, therefore, for a getting together on the part of Government officials, gas companies, Public Service Boards, commissions, and the public at large? Toluol is of advantage in illuminating gas only for an open-flame burner. As most people use gas mantles and as over 90% of gas is used for cooking, let there be an end to the old question of candle power and consideration of a sound basis of heat units. By so doing the first step toward recovery of the much needed toluol will be taken.

Chemist Board Appointed

A special board of chemists to investigate explosives and the use of gases in warfare has been appointed by Secretary Lane to act as advisers to the U. S. Bureau of Mines. The members are: Dr. William H. Nichols, of the General Chemical Co., New York, chairman; Prof. H. P. Talbot, head of the chemical department of the Massachusetts Institute of Technology; William Hoskins, of Chicago, a consulting chemist; Prof. H. P. Venable, of the University of North Carolina, E. C. Franklin, of Leland Stanford University and Dr. Charles L. Parsons, of the Bureau of Mines. The board will consider plans for increasing the production of materials used in explosives manufacture and will advise the bureau on the operation of the recently enacted Explosives Law.

Electrically Controlled Boats Old

Several electrically controlled boats operated by the Germans off Belgium have been destroyed by the British. These boats, which are not controlled by wireless, are described in an Admiralty report as being twin petrol engine vessels, partly closed in, which travel at a high speed. They carry a drum with between 30 and 50 miles of insulated single-core cable, through which the boat is controlled electrically. The forepart carries a considerable charge of high explosives, probably from 300 to 500 lb. The method of operating is to start the engine, after which the crew leave the boat. A seaplane, protected by a strong fighting patrol, then accompanies the vessel at a distance of from three to five miles, and signals to the shore operator of the helm. These signals need only be "starboard," "port," or "steady." The boat is zig-zagged while being steered into a ship, and the charge is exploded automatically.

The device is an old one. A boat similarly controlled was used by H. M. S. Vernon, a torpedo experimental

ship, as far back as 1885. The only new features in the German boat are the petrol engines and wireless signals, neither of which existed then.

Highways Transport Committee Is Named

Greater use of highways and inland waterways for short hauls to relieve the burden placed on railroads by the war is sought by the Council of National Defense in the appointment of a highways transport committee. The members are Roy D. Chapin, of Detroit, chairman; Logan Waller Page, Federal director of public roads; Henry G. Shirley, chief engineer of the Maryland State Roads Commission, and George H. Pride, of New York. Coöperative work with the various departments of the Government interested in the utilization of roads for military purposes will be started at once by the committee, which later will coördinate its work with that of the railroads and assist local highway authorities in maintaining the roads.

All forms of transportation are now represented in the Council for carrying on the war. Coöperation among transportation agencies, and not competition, is expected to be the outcome of the combined work of the committees. As the task of hauling freight long distances naturally falls to the railroads, it is planned by the Council to encourage the use of motor trucks for shorter distances, especially the movement of farm produce. Inland waterways will be relied on where available. Relief for congestion in railroad yards and at terminals will be one of the problems to be worked out in coöperation with the railroads.

What Industries Are Non-Essential?

"Before a conclusion can be reached as to what industry is non-essential during the war," says a bulletin of the U. S. Chamber of Commerce, "there must be known what is needed from abroad and what we may send in exchange, for what is apparently a non-essential here may be productive of most important materials for the war by being sent abroad in exchange for essential materials.

"For example, we need nitrate and copper from Chile. These are essential to the production of munitions of war. We may, however, procure this nitrate and copper by shipping jewelry or automobiles to Chile. Again, we need from Argentina wool, wheat and hides, and these necessities may be obtained by shipping in exchange sewing machines or typewriters. Thus the manufacture of a limousine or a typewriter may be in fact the means of producing nitrate or wool.

"What may be shipped to foreign countries depends upon what they are willing to receive from us and, therefore, it may be impossible to secure what is needed by shipping non-essentials. Cases may arise where we must draw upon our store of much-needed raw materials and finished products in order to procure raw materials which are in even greater demand. Thus, we may have to send coal or agricultural implements to Argentina in order to procure wool, wheat or hides. The extent to which we can afford to reduce our own much-needed supplies of coal and agricultural implements would depend upon the extent that we needed wool, wheat or hides. These are relative questions to be settled only after careful consideration of all the circumstances.

"Behind all this is the question of our gold supply—the great balance wheel of our foreign trade. This aspect of the situation may be illustrated by citing the situation with India. Among other things we need jute and burlap from India; in return we can send clocks and watches, typewriters, cloth and general merchandise, iron and steel pipe and fittings, etc. But this is not enough. The balance of trade is against us. To India we can send silver in settlement of this balance, but if this is not sufficient we must send gold or else allow American exchange to be at a great discount. The extent to which our gold supply may be drawn upon to settle foreign exchange balances raises all the questions of domestic finance—the Government's borrowing, the protection of our currency, and in fact our entire financial structure."

J. Leonard Replogle Appointed Director of Steel Supply

Appointment of J. Leonard Replogle, of New York, chairman of the Wharton Steel Co., and president of the American Vanadium Co., as director of the steel supply for the United States and the Allied nations, has been made by President Wilson upon the recommendation of Mr. Replogle's associates on the priority committee of the War Industries Board. Every requisition for steel for any of the Allied governments must be vised by the new director, who will determine to a great extent, the priority of orders placed by the Allies. Mr. Replogle's appointment is one result of the decision of the Allies to centralize and coördinate their activities.

Will Not Seize Deposits of Germans Living in United States

A. Mitchell Palmer, alien property custodian, has issued the following statement:

Some misapprehension seems to exist relative to the status, under the Trading-with-the-Enemy Act, of citizens or subjects of Germany and its allies resident within this country. Such persons are not included within the term "enemy or ally of enemy" as employed in the act. Deposits in the postal savings banks of the United States belonging to such persons are not liable to seizure by the Government and will not, therefore, be taken into the possession of the alien-property custodian or be interfered with in any way whatever.

Canadians To Make Shells for United States

Negotiations conducted by the Canadian Imperial Munitions Board at Washington have resulted in the placing of a large order of shells for French 75s, to be produced at Canadian plants for the U. S. Government. Six to seven and one-half million shells will be turned out in the first seven months of 1918. The Imperial Munitions Board will act for the American authorities in placing the contract and supervising the production of the shells. The American Ordnance Department will supply steel and component parts and the Canadian manufacturers will forge the steel and machine and assemble the shells.

Industrial News from Washington

BY PAUL WOOTON, SPECIAL CORRESPONDENT

Possession of Explosives Now Illegal Without License

Any person in the United States found with explosives in his possession and who does not have a license issued by the Federal Government showing the purpose for which the explosives are to be used, will be arrested at once and fined up to $5000 or sent to prison for one year. If the circumstances warrant, the person may be fined $5000 and in addition given the one year in prison.

This is the principal clause in a war measure passed by the last Congress which became effective Nov. 15. The manufacturer, the importer and exporter must likewise have licenses issued by the U. S. Bureau of Mines in Washington. The seller and the purchaser of explosives must also secure them. The licenses will be issued generally by county clerks, or other local officers who are authorized to administer oaths. There will be at least one licensing officer in each county, and more agents will be designated if the county is sufficiently large to warrant it. If a state has laws providing for a system of licensing persons manufacturing, storing, selling or using explosives, the state officials authorized to issue such state licenses shall be designated as Federal licensing agents; also city officials qualified to issue city explosives licenses will be given authority to issue Federal licenses. A Federal license will not relieve any person from securing such additional license as may be required under state laws and local ordinances. In each state there will be appointed a state explosives inspector, who will represent the Bureau of Mines in the administration of the law within the state.

Only citizens of the United States or of countries friendly to the United States and the Allies may obtain licenses. Contractors, mining companies, quarrymen and others using large quantities of explosives, which are handled by employees, may issue explosives to their employees only through those employees holding a license, called a foreman's license.

The purchaser of explosives, in obtaining a license, must state definitely what the explosive is to be used for and will be held accountable for its use as stated and the return of any that may be left. With the strict enforcement of this law, the Federal authorities hope to prevent explosives falling into the hands of evilly-disposed persons and put a stop to further dynamite plots.

It having proved impossible to license all users of explosives prior to Nov. 15, Francis S. Peabody, assistant to the Director of the Bureau of Mines in charge of explosives, has urged that "business as usual" be continued, to the end that there may be no loss of coal or metal production as a consequence. He says in part:

> On and after Nov. 15, all manufacturers, vendors, foremen, exporters, importers and analysts who deal with explosives or ingredients of explosives shall keep an itemized record of sales, issues or other disposition made of explosives and ingredients, pending receipt of detailed instructions and the securing of necessary licenses required by law.

More than 2000 persons have been designated to issue licenses. In most counties it has been necessary to designate only one person for this duty, but in some counties many more have been designated. In several Pennsylvania counties 15 have been found necessary.

Detailed instructions to licensors are to be sent out within a few days. A few of the paragraphs from these rather extended instructions are as follows:

> 13. Appearance in Person—Every applicant for a license must appear in person before the licensor. In the case of firms, associations, societies and corporations desiring a license for purchasing or vending explosives, or in the case of educational institutions applying for the analyst's, investigator's or educator's license, the application may be presented by and the license issued to the properly qualified officer of such firm, association, society, corporation or institution, and the license shall be made out in the name of the firm, association, society, corporation or institution; but a foreman's license shall be issued upon presentation of the application of the foreman in person and shall be issued to the foreman in person, as foreman of the designated individual, firm, association, society or corporation. A corporation official applying for the license for a corporation and a foreman applying for a foreman's license should present proper credentials to show his official capacity. The word "foreman" as used in the regulations designates the person actually issuing explosives from the explosives magazine and any other person who may be designated by his company to see that explosives are taken by a workman only to points necessary to the carrying on of his duties and that unused explosives are returned to a safe place, whether or not this man is known at the mine or plant or carried on the payrolls under the title of "foreman."
>
> 14. Citizenship—The law specifies that an applicant "shall state under oath his place of birth, whether native born or naturalized citizen of the United States of America; if a naturalized citizen, the date and place of naturalization." In the case of corporations, firms and associations, the nationality of the controlling stockholders must be indicated. Licenses will not be issued to enemy aliens or to subjects of a country allied with an enemy of the United States; or to a corporation, firm or association where its controlling stockholders or members are enemy aliens or subjects of a country allied with an enemy of the United States.

Sulphuric Acid Situation Acute

Faced with the certainty of an increase of 1,500,000 tons in sulphuric-acid requirements in 1918, intensive efforts are being made by several Government agencies to insure its production. The situation is particularly acute with regard to high-gravity acids. The War Industries Board has found it necessary to add a sulphuric-acid specialist to its staff in the person of M. F. Chase, of the Commercial Acid Co., of St. Louis, who will report to Mr. Baruch. Mr. Chase formerly was with the Mineral Point Zinc Company.

At present, the sulphuric-acid problem is receiving consideration by the War Industries Board, War Minerals Committee, Department of Agriculture, War Trade Board, Department of Commerce, National Research Council, Committee on Chemicals and the Committee on Fertilizers. In addition, the Shipping Board has under its jurisdiction the allotment of ships for importing Spanish pyrites. To date, the activities of these different agencies have not been successfully coördinated. It is apparent from Government investigations that pure sulphur must be used to obtain results quickly, and

Spanish pyrites. To date the activities of these different agencies have not been successfully coördinated. It is apparent from Government investigations that pure sulphur must be used to obtain results quickly, and that some industries must rely more upon the sulphur obtained from pyrites. Consumption of strong acids by certain industries can also be reduced, it is believed.

Manganese Output in Arkansas District Affected by Labor Shortage

After preliminary survey of Batesville manganese district of Arkansas, D. F. Hewett, of the U. S. Geological Survey, has concluded that, although the aggregate quantity of ore in the district is probably large, at present there is little prospect that the output can be doubled in the near future. Mr. Hewett just has returned to Washington from Arkansas.

Among the deposits examined by Mr. Hewett were those near Cushman, which are yielding high-grade ore. This is in the form of hard nodules ranging in size from that of walnuts to masses that weigh as much as five tons. Most of the high-grade ore near Cushman is found in solution cavities in the Izard limestone. The nodules are of psilomelane and braunite imbedded in the chocolate-colored clays that fill the cavities. These ores commonly range from 45 to 52% Mn and from 3 to 7% Fe. Much of the lower-grade ore, as well as some of that which runs over 40% Mn, is derived from deposits represented by weathered Cason shale. Deposits of this type are worked by opencut methods and at the Montgomery mine a washer has been installed to treat weathered material, which is the only one in the district. The area in which the deposits are known and indicated is about 15 by 25 miles, about one-fourth larger than outlined by Penrose in 1890.

For the last nine months the district has yielded 550 tons monthly of ore running more than 40% Mn; 700 tons monthly from 15 to 40% Mn and 100 tons monthly from 5 to 15% Mn. The limiting factors are the tedious method of mining, the distance of most of the deposits from the railroad, poor roads within the district and the scarcity of labor. Few shafts can accommodate more than four miners at work.

The output of the district bears a close relationship to the number of men employed. In October, during the cotton-picking season, the ebb of production for the year was reached, when it was two-thirds normal. Until recently the prevailing wage in the district has been $1.75 for surface men and $2 for miners per 10 hours. Wages have been advanced, however, so that surface men now receive $2 and miners $2.25 per nine hours. This has not drawn labor from the outside.

Manganiferous Iron Deposits at Silver City, N. M.

The old silver-producing area near Silver City, N. M., has recently become the most productive source of manganiferous-iron ore in that state. Since April, 1916, the Moses and Kirchman lease has shipped 31,000 long tons from several opencuts, none of which is over 15 ft. deep. The ore averages about 16% Mn, 35% Fe, 6% SiO_2, and 0.012% phosphorus. It is shipped to the Colorado Fuel and Iron Co. at Pueblo, Colo. The deposits were recently examined by Joseph B. Umpleby, of the U. S. Geological Survey, who says that even more ore is available on an adjoining group of claims owned by C. A. Stevens, of New York. These claims are not being worked. Dr. Umpleby said:

> The manganiferous-iron deposits crop out on the hill southwest of the town of Silver City and extend westward and northward along the south and west sides of Chloride Flat. The deposits are thus scattered over an area shaped somewhat like a fish-hook, open northward, with the point near the town limits of Silver City. The deposits are confined to areas of Ordovician limestones, and most of the ore is in the upper members.
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> The ore-bearing beds dip eastward at low angles, and in the immediate vicinity of Silver City are cut off by a mass of quartz monzonite porphyry. Several normal faults which cross the range offset the beds westward on the north. Parallel to these larger displacements are innumerable other faults too small to be traced at the surface. The orebodies are irregular replacements principally of lenticular outline and oriented parallel to the bedding. In a few places the manganiferous-iron ore occurs along the sides of narrow quartz veins, but in general there is no observed regularity in the distribution of orebodies. The largest mass developed is on the Stevens group of claims. It is exposed throughout the extent of an open cut 6 ft. deep and 300 ft. long, which crosses beds dipping 15° east. Smaller openings show that ore continues for 300 ft. farther west and 200 ft. farther east. Ore crops out at the surface on the slope above the line of open cuts to an elevation 60 ft. higher. As development of the manganese-iron ores has not reached deeper than 40 ft. below the surface anywhere in the area, and as the ores seem to have been leached from the overlying shales, tonnage below the level of exploration cannot be estimated with assurance. Nevertheless it seems safe to conclude that in this mass more than one-half millon tons of ore, apparently of a grade similar to that already shipped from the area, is available. Several other parts of the district show surface exposures of comparable extent and quality, but development on them is less advanced and an estimate of tonnage is more hazardous. It is apparent to one examining the outcrops and their wide distribution, however, that a very large tonnage of ore suitable for spiegeleisen can be easily developed in the Silver City area.

Mining in Tolovana District

After an exhaustive examination of the gold placers in the Tolovana district of Alaska, which is producing gold at the rate of $1,000,000 annually, J. B. Mertie, Jr., tells of some of his observations as follows: "Underground conditions for mining are excellent. The ground is solidly frozen from top to bottom. No water is present in the workings because so far no thawed ground or underground water-courses have been encountered. Little or no timbering is necessary. Examinations of untimbered workings a year old, from which all the gravel has been removed, show no tendency of the roof to cave. These favorable conditions have rendered mining much more economical than in the Fairbanks district. The gold found on Livengood Creek is high-grade, due evidently to the small content of silver; the mean proportion is 76 parts per thousand, compared with 82 to 172 parts per thousand in Fairbanks gold."

Mineral Survey of Idaho Completed

A mineral survey of Idaho, which has just been finished by Thomas Varley and E. K. Soper, of the United States Bureau of Mines, is to be the subject of a complete report now being prepared. A preliminary statement covering the more important features of the survey will be issued soon.

Editorials

The Labor Problem

THE extensive record of disturbing strikes all over the country, the recent threat of the railway men, the admonitions of the members of the labor division of the British Ministry of Munitions, who are visiting us, the address of the President to the American Federation of Labor, these and other things have caused us to awake to the realization that the labor problem is the most serious of all of our troubles in prosecuting the war. One British authority has remarked that if Great Britain had had so much labor trouble as we have had it would long ago have been out of the war. So widespread has been the unrest in the United States, and so virulent its manifestations that it is clear that the country must treat it in a different way than heretofore.

The fundamentals of the situation are these: Out of a male population of 20,000,000 above the age of 16 in gainful occupations other than agriculture and railway operation, about 2,000,000 have been called into the military services. This is not a clear subtraction, for a small portion of the 2,000,000 were previously in service. Even so, the subtraction is a large one. On the other hand there are offsets, especially the more extensive use of the labor of old men and of women, the forcing to work of the habitually idle (a surprising large number), and the diversion into productive work of men who previously served purposes of luxury. These figures give us no more than the general idea of labor shortage, and not of productive capacity. Involved with the latter are the questions of efficiency of labor and of administration, which are not easy to gage.

However, it is clear enough that there is a shortage of labor not only in the United States, but also all over the civilized world, and that is at the bottom of the general rise in prices for commodities. Individually prices rose in different degrees, especially in the earlier years of the war. Thus, some commodity might soar far above others, reflecting not only shortage of labor but also shortage of plant, the latter being indeed the immediate factor, and such extravagances of price were the inducement to capital to provide the additional plant. This was greatly to the benefit of certain classes of skilled labor, lead burners, for example. But in the course of time the increased cost of all commodities tended to approach the increase in the general average, which may be regarded as about 1.6 times the figure before the war. The cost of living has probably increased that much. Labor should have enjoyed a similar increase in wages. Has it? This is an extremely difficult question to answer, but before we condemn workmen for demanding more pay, let us consider whether they be not entitled to it. This is a concession that the employing class should make in their views and manner of thought. While on the subject of concessions by this class, let us say, moreover, that this is no time to advocate any policy of anti-unionism, or to seek to deprive labor of any of the rights that it has won. We preach to employers the principles of fair-mindedness and generosity, in short the square deal.

This is not to say that during the last three years labor on the whole has not got what it ought to, that a good deal of its present complaint may not be due to what the late James J. Hill characterized as the cost of high living as against the high cost of living. The situation is not sufficiently indicated by statistics. Undoubtedly there are disparities. We conjecture that the wages for common labor may not have risen so high, or so rapidly, as they ought to have done. On the other hand the wages for highly skilled labor have probably risen disproportionately high in some parts of the country, especially the East. In other parts the opposite may be the case.

Any consideration of this subject is confused by the matter of the decreased efficiency of labor that is reported from all quarters. In one important mining district it is said that while wages have been increased 40% the unit of work has decreased 40%. From another district comes the report that since wages have been increased the men have been working only five days a week, being able in that time to earn money enough. From metallurgical plants the reports are common that not only have costs of smelting increased but also extraction of metals has decreased owing to the indifference and carelessness of the men. If the net result were as bad as these things indicate the outlook would be black indeed. The partially redeeming feature is that administrators have been able under the prick of necessity to introduce economies in operation that have offset the wastefulness of labor both in work and material to more or less degree. The most striking example of this is to be found perhaps in the running of the railways, which would be in a far more desperate situation had it not been for the remarkable feats in increasing car loading and decreasing unnecessary travel during the last six months.

There is no more loyal citizen than Samuel Gompers. The labor leaders who are less well known are loyal. Labor itself is loyal, we are convinced. But labor does not see clearly what it has to do to help win the war. It is the duty of its leaders now to lead if ever they are going to lead. Let them preach that the man who does an honest day's work of any kind is doing his bit. Let them preach that there should be waste of neither time nor material. If the energy of eight hours of work can be made to produce more by being properly exerted let the instruction of the managers be obeyed, not resisted and nullified. If a man can earn enough to satisfy himself in five days of the week let him not idle on the sixth, but let him work and subscribe the proceeds to liberty bonds. Let there be thrift in the expenditure of money for living expenses, cutting out the luxuries.

Another thing that may well be borne in mind by the dissatisfied is this: Large dividends by great corporations do not necessarily represent profiteering, and not even excessive war profits. If the cost of commodities, the cost of living and the wages for labor have risen on the average about 1.6 what they were before the war the share of capital ought to rise in the same proportion. A dividend of 8% on capital means no more now than 5% used to. Bear in mind, too, that things are often not what they seem. There are companies that thought they were earning enormous sums in 1916, and so represented, that have had to pass their dividends in 1917, for they were not really earning what they thought they were.

When the United States entered the war the precept that was commonly preached was "Reduce consumption and increase production." That was good advice and conformity to it would have put the country further ahead than it is now. We have reduced consumption, partly by the natural check of high prices and partly by the strong-arm tactics of the Government in forbidding it. But we have also reduced production, for which the subtraction of men is partly responsible, though much blame must fall on both capital and labor. If we are going to win the war quickly there must be a revision of policy.

Capital must be more broadminded and generous and must not seek advantages for itself.

Labor must also be more broadminded and must do full-time work, with the maximum possible efficiency, and must be thrifty.

If Capital and Labor can unite on these principles with Brains as the third leg of the stool, the United States will build aëroplanes, and ships, and guns with such celerity as to startle the Huns and will produce enough food and other things to be comfortable in the meantime.

The Twenty-Seventh Engineers

ONE of the plans to help win the war is to adopt a soldier, to look out for him, make him happy and thus improve his efficiency. In behalf of the mining industry we have adopted a regiment, the 27th Engineers, which is a mining regiment. The officers of this regiment are well-known mining engineers. We are helping them recruit their ranks from the miners of the country. We have asked mine managers and mining companies to assist. Everybody wants this to be a very fine and very efficient regiment.

Naturally the mining industry should take care of its own. We want these men to know that the industry in which they have worked, of which they are a part, appreciates what they do when they risk all for the service of their country. Let them know that their industry stands back of them, ready to aid them in their troubles, with constant thought of them; let them know that there is someone, like a godfather, to whom they may look for friendly help.

We propose to organize a Comfort Club for the 27th Engineers, a club that will subscribe a fund out of which may be furnished cigarettes, pipes and tobacco, sweets and such other comforts as may be needed and the resources of the fund make possible. These things will be needed now and they will be needed continuously. In administration the officers of the regiment will cooperate.

We ask our readers to subscribe to this fund, drawing check to the order of the *Engineering and Mining Journal*. Subscriptions will be reported promptly in our columns. None will be too small to be thankfully received and none will be too large. From time to time reports will be made of what is done with the money. Now is the time to subscribe. The *Engineering and Mining Journal* starts the list with a subscription of one thousand dollars.

The Prospects of the Copper Companies

UNTHINKING people received rather a shock last Friday when the Jackling companies came out with their statements showing a deficit in the third quarter of 1917, i.e., they had failed to earn their dividends. Their explanation was overlooked, although it was clear and simple. During that quarter they had sold only a part of their copper and had inventoried the unsold part at 13½c., thus greatly reducing gross earnings on their books. In reality there was no such great reduction, for the inventoried copper was subsequently sold at 23½c., the delay being due to the negotiations with the Government. These reports were misinterpreted as forerunners of a decline in the copper industry, reduction of dividends, etc.

But what are the real prospects of the copper companies? In the first place they are receiving by agreement with the Government 23½c. for their copper until the end of January, 1918. This is only about 1½c. per lb. less than they averaged in 1916. There has been talk about the price being raised or lowered after the end of next January. In fact, that matter has not yet been considered between the contracting parties. We do not anticipate a lowering, for there is a shortage of copper and there will hardly be any action deliberately to restrict production.

However, apart from the matter of selling, the position of the copper companies depends upon how much they must pay in taxes. Some brokerage houses and statisticians have issued computations purporting to show what the several companies will have to pay. These have been guesswork and rather foolish. Among the managements of the principal companies no one yet knows how to figure the tax, and until there have been decisions by the Bureau of Internal Revenue it will be a waste of time to try to do so. The chief items of uncertainty are: (*a*) What is capital, (*b*) what is earned surplus employed in the business, and (*c*) what shall be the deduction from gross earnings for depletion of the mine? Although there is uncertainty about the last it is clear that it will give mining companies, and properly so, a large exemption.

Amid all of these uncertainties it is impossible to think safely of anything but general principles, which may be summarized as follows: Owing to the allowance for depletion, no mining company will have to pay so much as might appear from first sight. Allowance for depletion having been deducted, companies with a large capitalization are in a more favorable position than those earning about the same amount but having a relatively small capitalization. Thus, there can be no doubt about Anaconda being much better off than Utah.

But Utah, which has accumulated a great surplus, is in turn better off than other companies of relatively small capitalization which have distributed in large dividends the bulk of their great earnings in 1915-17.

As to future dividends the prospects are generally proportional to the conservatism exhibited during the boom years. Some companies that have tripled and quadrupled their dividends, disbursing the bulk of their earnings, will probably have to cut them considerably. Those that have been conservative will probably keep on at the present rate. There will be many in an intermediate position. Considering the two largest producers, Utah, which paid $4 per share before the war, raised its rate finally to $14. That was not quite so extravagant as it looks superficially, for in 1914 Utah was still a young company, which was earning a great deal more than it was distributing in dividends, it being still engaged in accumulating an adequate working capital. Having accomplished that it was entitled to increase its dividend and would have done so under normal conditions, but the eventual increase to $14 undoubtedly reflected the division of war profits. Utah will continue to earn a great deal of money, but we anticipate that the payment of war tax will cause its directors to be somewhat less lavish and we conjecture that its dividend rate may be cut to $10 per annum.

Anaconda was the most conservative of all the companies, its rate before the war having been $6 per share and its increase during the war having been only to $8, which it probably would have been able to maintain, war or no war, on any decent copper market by virtue of its improvements in mining and metallurgy and its expansions. Its great earnings above its relatively modest dividend have been put back into the business and used for payment of its notes. Anaconda has become, in fact, a great industrial company, like the American Smelting and Refining Co., with important mining interests, and so differs from the mining companies pure and simple, like Utah. Anaconda, owing to its large capitalization, will not have to pay a large tax in proportion to its earnings and its prospects for maintaining its present dividend rate are unblemished. Indeed, Anaconda's increased earnings from silver and zinc ought nearly to offset its war profit tax.

The American Smelting and Refining Co., which is often classed among the "coppers," and is indeed the largest seller of copper, is not an original producer except to a slight extent. It buys copper in crude form from producers or receives it for smelting and refining on toll and sells the refined product. The American Smelting and Refining Co. is essentially an industrial company—the magnitude of its business being measured fundamentally by the tons of ore and crude metal it can smelt and refine—but it has also important mining interests. Considered broadly there is a good deal of similarity between the natures of the business of the American Smelting and Refining Co. and Anaconda, both being metallurgical companies with mining interests, the difference being that Anaconda's are larger and are mainly in copper, while those of the A. S. & R. Co. are in lead. From the angle of the war-tax law, the American Smelting and Refining Co. has the benefit of a large capitalization and surplus employed in the business, but it is not clear how its capital may be figured under the terms of the law. Moreover, its capital is divided among bonds, preferred stock and common stock, wherefore the onus of the tax falls on the last. The earnings of this company are so large, however, that it is not believed that the tax will necessitate any reduction of the 6% dividend on the common stock, but it will probably check expansions in business for which surplus earnings have been largely employed.

The Porphyry Reports

ANOTHER misconception that arose from the statements of the porphyry companies pertained to the light that they were considered to throw on the copper market previous to the consummation of the agreement with the Government. "If these companies could not sell their copper the market must have been in a parlous state and the Government's price was a generous relief to the producers," it has been said. This is quite erroneous, especially in its implication that unsold stocks of copper had been accumulating.

The porphyry mines deliver their product in crude form to smelters and refiners, who are not ready to deliver the refined copper to consumers until 90 to 100 days later, but expecting to make such delivery normally they sell it ahead, and the producers, knowing what they are going to receive, can take such sales into the quarter of original production. When the porphyry companies said that they had not sold their third quarter copper they meant that they had not sold what they would have ready for delivery in the form of refined copper in October, November, December and January.

This followed from the great contraction in buying in August and September, and even earlier, when the negotiations with the Government were in progress. Reference to the weekly market reports for that period makes this quite clear. Europe did not buy, nor did domestic consumers, except in cases of urgency, it being well known that the Government's action would determine the market, no matter what that action might be. It was clearly foreseen by producers, even at that time, although not by consumers, that when the fourth quarter actually arrived there would not be copper enough and the porphyry companies would have been justified in writing up their third quarter production to a higher figure, but they preferred to enter the uncontracted part of it at the nominal price of 13½c., which they adopted as their inventory valuation when they first engaged in business, years ago. The whole thing was, therefore, simply a matter of bookkeeping, which will cause the correction to be made in the accounts for the fourth quarter.

However, the arrangement with the Government terminates with the end of January and unless extension is made sufficiently early the companies that keep their accounts in this way will not know how to compute their fourth quarter production, which will not be fully available for delivery until, say, April, 1918. Incidentally, it may be remarked that copper-producing companies differ in their methods of keeping their accounts in this respect, and it may be pointed out that the arrangement of Sept. 21 between the producers and the Government abolished the old trade custom of selling for future delivery and put the market upon a spot

basis, which prohibits business by many concerns that formerly bought copper in crude material out of which they could not deliver the refined until months later.

The Army Behind the Army

THE "army behind the army" will win this war. Victory is assured to that side which can keep its industrial army mobilized at highest efficiency, which can keep its soldiers at the front supplied with the necessary munitions and supplies.

Shall we who stay at home let our soldiers sacrifice their lives needlessly? Shall we let victory slip from our grasp because the industries behind the line fail to do their part?

The poster supplement mailed as a part of this issue of the *Engineering and Mining Journal* is intended to remind every citizen of the importance of supporting to his fullest capacity the men under fire. "Is this my boy?" should bring home to every one of us the necessity of supplying the boys in the trenches with all they require in the way of food, clothing, metals, explosives and the myriad accessories of modern warfare. Every mine, every farm and every shop engaged in the production of essential war materials should be operated steadily at such capacity as may be specified by the needs of the Government, and no internal dissensions should be allowed to interrupt the steady flow of munitions during the next three or more years that may be required to restore international law. We can steadfastly concentrate on the production of the supplies needed by our soldiers and win the war as certainly as we outmeasure Germany in resources.

Shall we think in time? Or shall we wait until our army has had to relinquish hard-won ground because of a shortage of some of these essential supplies and then have to regain, with the sacrifice of thousands of lives, territory that might easily have been held had we, behind the lines, done our part?

Regard for a moment Russia and think what she might be capable of if properly unified, munitioned and led; think of the lives and territory that have been lost because of disorganization behind the lines. Look at Italy, who has relinquished her hard-earned victories and now is in a critical condition because she temporized with her pacifists and reduced her munition output while the Germans prepared their sledge-hammer blows against the inadequately equipped Italian army. These two catastrophies, with their attendant loss of territory and men, should be an object lesson to us and cause us to put our shoulders unitedly to the wheel and keep our boys supplied with the maximum requirements for successfully bringing the war to its speediest close. Let us win the war first; settle our petty differences afterward.

Silver

IT WAS reported in the papers this week that Great Britain and the United States had agreed to fix the price for silver, there being several versions as to how this was to be done. These reports were incorrect. However, it is true that there are negotiations pending. Until these are consummated and the plan has been published, comment is useless.

BY THE WAY

By a recent transaction in the Cripple Creek district of Colorado, the surface rights of four mining claims were transferred to a farmer for grazing purposes. The Cripple Creek district, before the discovery of gold, was only summer pasture land. "It is to be hoped," writes the engineer who sent in this information, "that this deal does not inaugurate a general return to the former industry, but that the famous gold-producing section may continue to produce gold instead of beef for a long time to come, no matter how badly we may need the beef, for some of us need the gold before we can get the beef."

The Quicksilver Mining Co. of California, one of the oldest companies in the state and at one time the largest producer of quicksilver, has made application through its directors for the appointment of receivers and the dissolution of the company. It has been organized over 60 years and at one time did a profitable business, but for some years past its mines have produced nothing and the assets listed in the application are less than the liabilities, leaving nothing at all for the $10,000,000 stock. There has been no production for several years and the New Almaden tract—the main asset of the company—is valued in the present statement at only $10 per acre. All of which goes to show that mines are not everlasting and that it pays to practice amortization when profits are going.

In the days before the adoption of safety measures which characterize the mining of today, little attempt was made to protect the men underground. Every man was expected to look out for himself. It was the misfortune of a "Cousin Jack" miner in one of the Michigan iron mines to walk inadvertently into an open raise, with the result that he was picked up on the level below, a short time afterward, with both legs broken. He was conscious, however, and offered the following explanation of his mishap: "Damme, boys, never 'ad anything like that 'appen befoor. 'Ere I was walkin' 'long they bloody drif' an first thing I nawed there was bloody shaf'. Started out to step on plank, an' damme, plank wasn't there. So down comes I, shaf', plank and all. What's think on it?"

A group in a downtown club were discussing the recent mayoralty election, says the *Wall Street Journal.* "What we need in New York is a general manager," said a prominent lawyer. "The people should elect directors. They in turn would elect a president and other officers. The president in conjunction with the directors would appoint a general manager. He would run the city. The people could elect a new board of directors annually, but they would have nothing to say about the general manager, and——" "Wait a moment," interposed a director of one of the largest railroads in the country. "Tell me where in the world New York would get a man capable of running it? If such a genius could be found we would offer him the presidency of our road at five times the salary any city would pay him."

Ferrotungsten and Ferromolybdenum Production in Colorado

BOULDER CORRESPONDENCE

Several elaborate plants for the production of ferrotungsten, tungstic acid (yellow powder), and ferromolybdenum have been built within the last two years in Colorado, near Boulder and Denver. They are somewhat similar to the Eastern plant of the Primos Chemical Co., of Primos, Penn. Local capital was used, generally supplied by men who had made money in mining and milling tungsten during the boom. Small electric furnaces were built, copying Swedish practice, for producing the ferroalloys. The tungstic acid is being made by chemical processes, one of the most successful of which and one that yields an extremely pure product, being devised by John B. E. Riley, professor of chemistry at the University of Colorado, who is interested in a small plant utilizing the process at Boulder. A good deal of secrecy has been maintained in the operations of rival companies.

The electric furnace used for making the ferroalloys is about 4 ft. high, cylindrical, vertical, and lined with a mixture of ground coke and tar which is tamped about 8 in. thick between two sheet-steel forms, after which the inner form is removed. The vertical electrode, 3 to 7 in. in diameter, descends through a hole in the firebrick top, forming an arc with a bottom electrode surrounded by coke and fixed in the floor. Feed wires supply current to each; the arc is drawn out several feet in length after the furnace is well in operation. The electrode is usually water-cooled, and is raised and lowered by a cable and worm-wheel windlass.

The charge consists of tungsten concentrates, lime, fluorspar, coke and charcoal, and is added slowly after the arc has been formed, a piece of metal first being put on the lower electrode to start the arc. About 75 to 90 kw. are maintained at the wattmeter. After three or four hours the metal begins to settle. If the mixture boils high, more fluorspar is added.

An iron bar is stuck into the mixture to test it. If the slag cools black and glossy, lime is added; if brown and smooth, coke; if smooth gray-green, the slag is ready to be tapped. After tapping the slag, another charge is added, and so on until the furnace shows signs of breaking. The furnace is then shut down and cooled, preparatory to breaking into pieces for removing the button of ferrotungsten in the bottom, which weighs several hundred pounds.

To continue smelting, a new furnace must be constructed, because the tungsten is so difficult to melt that it will not run like copper or lead. The button is put through a crusher and rolls, and assayed. To remove surplus carbon, it is refined in a refining furnace, and then is shipped to the East. Of course, sulphur and phosphorus are kept as low as possible; the tungsten content of the final product is usually about 80%.

For the most part, these smelting and chemical operations have been developed by the typical American method of pragmatical "try and see." Mixed successes and failures ensued, as ability and money were brought to bear on the problem. Many young chemists have had to devise methods of testing substances for which there are no rules in the book. Molybdenum is coming into use more and more, and tungsten operators are beginning to fear its effect. Many of the excesses of the tungsten boom have passed, and no longer do hopeful prospectors stick at minute veins of dark-colored valueless minerals waiting for them to turn to tungsten.

Nevada Consolidated Quarterly Report

The report of the Nevada Consolidated Copper Co. for the quarter ended Sept. 30, 1917, shows a production of 20,217,673 lb. of copper, as compared with 20,817,356 lb. in the previous quarter. The monthly production was: July, 7,253,337 lb.; August, 6,439,984 lb.; September, 6,524,352 lb.; average, 6,739,224 lb. During the quarter 1,014,031 dry tons of Nevada Consolidated ore, averaging 1.46% copper, was milled, comparing with 1,021,990 dry tons, averaging 1.46% copper, for the previous quarter. In addition to the above 69,762 tons of Consolidated Coppermines ore was milled in the quarter. The cost of copper produced, including the Steptoe plant depreciation and all charges except ore extinguishment and after crediting all miscellaneous earnings, is reported at 11.78c. per lb., as compared with 11.02c. for the previous quarter. Excluding the item of depreciation, the cost was 10.93c., as compared with 10.19c. for the previous quarter. A Red Cross dividend of 15c. a share was declared on July 25, and on Sept. 29 a dividend of 50c. a share and a capital distribution of 50c. a share were paid.

Chino Quarterly Report

The report of the Chino Copper Co. for the quarter ended Sept. 30 shows the gross production of copper contained in concentrates from milling operations was 21,887,496 lb., comparing with 20,546,593 lb. in the previous quarter. The average monthly production was: July, 7,343,767 lb.; August, 6,824,127 lb.; September, 7,719,496 lb.; average, 7,295,797 lb. per month.

The total amount of ore treated was 966,000 tons, averaging 10,500 tons per day, and is a record amount for any quarter since the beginning of operations. The average copper content was 1.609%, comparing with 1.704% in the second quarter. The recovery per ton of ore milled was 22.658 lb. gross, as against 23.986 lb. gross for the previous quarter. There was produced 75,121 dry tons of concentrates averaging 14.568% copper, compared with 66,764, averaging 15.38% copper, during the second quarter.

The cost per pound of net copper produced, after allowing for smelter deductions and crediting all miscellaneous income, was, according to the report, 12.14c., as against 9.65c. for the second quarter. The net returnable copper for the third quarter was 20,888,408 lb. The copper content of the ore treated was about 2 lb. per ton of crude ore less than for the second quarter and the higher cost per pound is chargeable, first, to smaller amount of net returnable copper, second, to a higher cost of labor and supplies, and third, to inclusion, beginning in August, of a monthly depreciation charge. A quarterly dividend of $2.50 per share was paid to the stockholders on Sept. 30, in addition to a Red Cross dividend on July 25 of 40c. per share. During the third quarter, a total of 1,372,741 cu.yd.

of material was removed by steam stovels at Santa Rita, as against a total of 1,419,494 cu.yd. for the second quarter. Of the total material removed, 887,326 cu.yd. were stripping, the remainder being equivalent to 963,177 tons of ore averaging 1.612% copper.

Utah Copper Quarterly Report

The report for the quarter ended Sept. 30, 1917, of the Utah Copper Co. shows the total gross production of copper in concentrates amounted to 54,762,554 lb., compared with 56,403,465 lb. for the previous quarter. The monthly production was: July, 18,127,154 lb.; August, 18,796,012 lb.; September, 17,839,378 lb.; monthly average, 18,254,181 lb. In addition, 236,924 lb. of copper in ore was shipped direct to the smeltery, making the total gross production for the quarter, 54,999,468 lb. as compared with 56,845,059 lb. for the previous quarter. During the period 3,439,400 tons of ore was treated, being 141,000 tons more than for the preceding quarter. The average grade of the ore was 1.309% copper, as compared with 1.3881% copper for the second quarter, and the average extraction was only 60.96%, owing to the unsettled operating conditions while improvements were being made and the comparatively low copper content in the headings. A total of 1,230,677 cu.yd. of capping was removed, as compared with 1,219,198 cu.yd. in the second quarter.

The average cost of copper produced from concentrates as stated in the report, after allowing for smelter deductions and crediting miscellaneous income from Utah operations only, including Bingham & Garfield Railway operations, was 10.860c., as compared with 9.464c. in the second quarter, the increase being due partly to increased state and Federal taxes, partly to increased wages effective July 1, and partly to the low grade of ore. The regular quarterly cash dividend of $3.50 per share was paid on Sept. 30. During the quarter, there was also paid a Red Cross dividend of 50c. a share.

[The regular quarterly cash dividend of $3.50 as given in the report may include a capital distribution to the shareholders of the company, although such is not stated.—Editor.]

Engineer Service Overseas

Engineers are wanted for early service overseas. The men in the front-line trench need the help and coöperation of skilled men back of the lines, and engineers are wanted at once for the Enlisted Ordnance Corps, National Army.

Uncle Sam is calling on our trade to come across and help his fighting men. There is a lot of work to be done over there, and the call has gone out for engineers between the ages of 18 and 40 who want to do their bit, and who know their job.

Modern war is a tremendous business, and the army that wins is the army which has the best equipment and the best men. The men are over there now—they are ready to go ahead, but they still need experts in our line to repair and maintain their equipment. There is a fine chance for every man who wants to help. Write to the Chief of Ordnance, War Department, Washington, D. C.

Agree on Iron Price Differentials

The following statement has been issued by E. H. Gary, chairman of the committee on steel and steel products of the American Iron and Steel Institute:

By agreement between the general committee on steel and steel products of the American Iron and Steel Institute and the War Industries Board, approved by the President, the base price of No. 2 foundry iron and also basic iron was fixed at $33 per gross ton, f.o.b. cars at furnace.

From these base prices the Sub-Committee on Pig Iron, Iron Ore and Lake Transportation has reported to the general committee a list of differentials, which the general committee believes as fair and reasonable and in accordance with the usages of the trade, and therefore recommends to the iron industry that the same be adopted to take effect immediately. The list of differentials is as follows:

Foundry Iron—No. 2 grade is to be equivalent in analysis to: Silicon, 1.75 to 2.25%; sulphur, not over 0.05%. No. 2 soft Southern iron equivalent to No. 2 foundry of same silicon content. Differentials from the above base price for No. 2 foundry iron are to be made for the following changes in specifications: Forge or mill iron, $1 per gross ton under base; foundry iron running silicon 1 to 1.75%, 50c. per gross ton under base; foundry iron running silicon 2.25 to 2.75%, 50c. per gross ton over base; foundry iron running silicon 2.75 to 3.25%, $1.50 per gross ton over base; foundry iron in excess of 3.25% silicon, $1 per gross ton for each ½% of silicon over the price for 3.25% silicon iron; manganese, sulphur and phosphorus variations to be adjusted as formerly customary in each district having respect to the base price. Where iron is sold by fracture the usual grading prevailing in each district is to continue. Malleable iron, 50c. per gross ton above base; bessemer iron, 10% per gross ton above base; basic iron, base price.

Charcoal Iron—Southern or warm-blast charcoal iron a maximum of $10 per gross ton above base for iron ranging from 0.4 to 0.6% phosphorus, and silicon 1 to 2%; for grades running below these analyses corresponding reductions as usual to the trade to be made; cold-blast charcoal iron a maximum of $22 per gross ton above base with customary reductions for lower grades, as recognized by the trade; Lake Superior iron, $2.50 per gross ton above base for iron averaging 1.25% silicon. Other grades to be adjusted as per the custom of the trade depending upon the silicon, phosphorus and manganese contents of the iron; all of these charcoal-iron differentials to be considered in connection with base price.

High Silicon or Silvery Iron—For iron containing 6% silicon, $7 per gross ton above base; 7% silicon, $9 per gross ton above base; 8% silicon, $11.50 per gross ton above base; 9% silicon, $14 per gross ton above base; 10% silicon, $17 per gross ton above base; $3 per gross ton advance for each 1% silicon for 11% and over.

Bessemer Ferrosilicon—For iron containing 10% silicon, $22 per gross ton above base; 11% silicon, $25.30 per gross ton above base; 12% silicon, $28.60 per gross ton above base.

Low Phosphorus Iron—Iron containing phosphorus and sulphur not exceeding 0.04% and silicon not exceeding 2%: For copper-bearing iron, $17 per gross ton above base; for copper-free iron, $20 per gross ton above base; a sliding scale of $1.50 per gross ton advance for each reduction in phosphorus of 0.005% below 0.04%, and $1.75 per gross ton advance for each 1% of silicon in excess of 2%.

The Republic Iron and Steel Co. reports for the half-year ended June 30 that its total net earnings, after paying operating expenses and repairs, were $15,716,753, against $6,823,026 for the first half of 1916. Rents, depreciation and exhaustion of mines were $635,577; bond interest, $399,189; extra profits tax, $2,204,654; total charges, $3,239,420, leaving a surplus of $11,477,333. From this dividends were paid amounting to $875,000 on preferred and $815,730 on common stock, leaving an undivided surplus of $9,786,703. The total profit and loss surplus as of June 30, 1917, was $27,923,584. Unfilled orders on June 30 amounted to 528,976 tons of material.

Personals

H. C. Wilmot is on a professional trip in Arizona and New Mexico.

G. M. Clark has been elected president of the South African Institute of Engineers.

P. B. McDonald is instructor of engineering English at the University of Colorado.

Douglas Muir is superintendent of the Nevada Austin Mines Co., Austin, Nevada.

Robert Sticht was recently in Anaconda, Mont., where he visited the Washoe smeltery.

R. B. Watson, general manager of the Nipissing Mining Co., Cobalt, Ont., has been visiting Arizona.

W. B. Rhodes has returned to Colombia. His address is Olimpo del Valle, Mangangue, Colombia, South America.

G. W. Laurie of the firm of Drucker & Laurie, 50 Church St., New York, has joined the 23rd U. S. Engineers.

Dr. Raymond Brooks has returned to San Francisco after visiting the Flin Flon copper district in northern Manitoba.

R. A. Tregoning, recently on the engineering staff of the Braden Copper Co. of Chile, is visiting his home at Hubbell, Michigan.

J. E. Thropp, Jr., has been appointed superintendent of the blast furnaces of the American Rolling Mill Co. at Columbus, Ohio.

John Seward sailed from New York for Venezuela on Oct. 31, on professional business, to be gone until the middle of January.

William C. Russell, general manager of the Caribou Mines and Mills Co., of Cardinal, Colo., is on a business trip to New York.

Edwin W. Mills was in Vladivostok in October, having returned from an interesting Siberian trip. He then left for Peking, China.

B. C. Austin has resigned his position as manager of the Mountain King Mining Co., and will open an office in San Francisco as consulting engineer.

Philip Berg, recently engineer for the White Pine Extension Copper Co., has been appointed assistant superintendent of the Michigan Copper Mining Company.

Horace V. Winchell, recently returned from Russia, gave an interesting account of his experiences there at a luncheon on Nov. 8 at the Rotary Club at Butte, Montana.

Benjamin B. Thayer arrived in Butte, Mont., from New York on Nov. 9 for his regular tour of inspection of the Montana properties of the Anaconda Copper Mining Company.

Allen Hastings Rogers, Lucius W. Mayer and **Sydney H. Ball** have formed a partnership under the title of Rogers, Mayer & Ball, and have opened offices at 42 Broadway, New York.

C. A. Thomas, who resigned some months ago as resident manager of the Yukon Gold Co., has been appointed assistant to E. B. Braden, president of the Selby Smelting and Lead Co., of San Francisco.

Frank H. Sistermans, mining engineer, of El Paso, Texas, is in Cuba on professional business and will be absent for several months. His present address is Santiago de Cuba, care of the U. S. Consulate.

Sir Boverton Redwood, director of petroleum research for the British government, has taken charge of the work of coördinating petroleum production and research, and has resigned his position as director of petroleum research.

E. J. Carlyle, metallurgical engineer, and **M. R. Hull,** mechanical engineer for the Sissert Mining District Co., of Petrograd and London, arrived in San Francisco, Nov. 9. They will spend some months in America in the interests of their company.

E. H. Whitlock, consulting engineer, Cleveland, Ohio, and director of Wellman-Seaver-Morgan Co. of that city, who has been in the Government service several months, is now in the Ordnance Department at Washington with the rank of major.

Maurice Vandeputte, formerly preparator in geology at the University of Mons, Belgium, now interned in the Camp of Zeist, Holland, wishes to communicate with Belgian engineers who were formerly members of the Faculté Polytechnique of the University.

Jay C. McLauchlan, of Pickands, Mather & Co., Cleveland, Ohio, has been appointed assistant to J. Leonard Replogle, who has charge of iron and steel matters for the War Industries Board. Mr. McLauchlan will give particular attention to the supply of pig iron.

Dr. J. G. Davidson of the department of physics, of University of British Columbia, has been commissioned by the Canadian Government to install a plant in eastern Canada for the production of coke-oven byproducts, with the object of securing benzol and toluol for war purposes.

Obituary

Zophar W. Wright, for many years financial manager of the Detroit & Lake Superior Copper Co. and its successor, the Lake Superior Smelting Co., died at Ripley, Mich., on Nov. 12, aged 85 years. In 1878 Mr. Wright became president of the Houghton National Bank, holding that position for 24 years and retaining his interest and directorship in the bank until his death. He was buried at Detroit, Michigan.

Daniel Reid Lean died in Pittsburgh, Nov. 15, aged 78 years. Born in Scotland he came to this country in 1869, and soon after took service with the firm of Carnegie, Kloman & Co. as the repairer and liner of blast furnaces. Later he built the first Lucy furnace and other stacks for that firm and its successors. After several years as contractor for the erection of furnaces, he retired from active work, retaining some interests in iron and lumber companies.

A. M. Finlayson, a graduate of the Royal School of Mines, was recently killed in action. He was born in New Zealand where in 1908 he won a research scholarship on which he entered the School of Mines in London. In a short time he received the degree of D.Sc., for work on the Rio Tinto (Spain) deposits. He wrote an article on the gold and silver veins of Great Britain and numerous papers on New Zealand geological problems, mainly in connection with scheelite and gold-silver veins. Prior to the war he held a geological position with an English oil company in Burma, but gave this up to enlist early in the war, in which he was commissioned a second lieutenant.

Societies

Engineers' Club of Northern Minnesota held its November meeting at Hibbing on Nov. 17.

American Institute of Mining Engineers, New York Section, will hold a meeting on Nov. 26, at the Machinery Club, New York, at 8 p.m., preceded by an informal dinner at 6:45 p.m. Legislation affecting the metal industries will be discussed.

Montana Society of Engineers held a meeting on Nov. 12, in Butte. V. Arthur Walcutt read a paper on the new "Elm Orlu Electric Hoist" and Frank A. Linforth recounted his experiences on a recent examination trip to the interior of Costa Rica.

American Society of Mechanical Engineers, New York section, held a meeting, on Nov. 13, in the United Engineering Bldg., New York. The subject of discussion was the "Development of Mechanical Engineering Problems met by the Designer and Contractor on Concrete Piling," by Maxwell M. Upson, chief engineer of the Raymond Concrete Pile Company.

Western Engineering and Technical Headquarters has been opened in the Sheldon Bldg., San Francisco, with George C. Ryno and U. R. Grant as managers. The organization is planned on the same lines as the Chemists Club of New York, providing comfortable quarters for visiting technical men and assistance in obtaining employment, if desired.

Society of Chemical Industry, New York Section, held a meeting at Rumford Hall, 50 East 41st St., New York, on Nov. 23, opening at 8:15 promptly. The papers presented were: "Disposal of Wool-Scouring Wastes," R. S. Weston, Boston, Mass., and "Manufacture and Uses of Portland Cement," E. D. Boyer, New York. The latter was illustrated with lantern slides and moving pictures.

United Engineering Society and the four founder societies held a meeting, on Nov. 14, in the United Engineering Bldg., New York, in celebration of the completion of the Catskill Water Supply project. George H. Pegram, president of the American Society of Civil Engineers, presided. Addresses were made by John Purroy Mitchel, mayor of New York, and by Maj. Gen. George W. Goethals. An illustrated description of the work was given by A. D. Flinn, deputy chief engineer of the New York Board of Water Supply.

Industrial News

Mark R. Lamb has received orders from Bolivia for a 600-hp. Diesel alternator unit, a switchboard transmission line and transformer equipment.

Boston Belting Co., Boston, Mass., has made a shipment of rubber belting, weighing 22 tons, from its plant at Boston to the Burma Mines Corporation, Tawng Peng, Burma.

Charles E. Newton, who has taken charge of work in ore dressing and metallurgy at the School of Mines of the Oregon State Agricultural College at Corvallis, Ore., wishes to receive current trade catalogs of mining, smelting and ore-dressing machinery.

T. L. Smith Co., Milwaukee, Wis., has introduced a new type of concrete mixer, styled the Smith-Chicago mixer with under-slung chain drive. The feature advertised is that the chain, instead of going around the mixer drum, passes under the truck frame, around an idler pulley on the shaft of the rollers supporting the drum and thence back under the drum. The drum thus acts as a constant and automatic tightener. The upward pull on the chain produces a good contact between the chain and the sprocket teeth.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Air Compressor. William Everett Ver Planck, Erie, Penn., assignor to General Electric Co. (U. S. No. 1,245,643; Nov. 6, 1917.)

Alloy. Frederick M. Becket, Niagara Falls, N. Y., assignor to Electro Metallurgical Co., Niagara Falls, N. Y. (U. S. No. 1,245,552; Nov. 6, 1917.)

Aluminous Ores, Process of Treating. Harold A. Richmond, Providence, R. I., assignor to General Abrasive Co., Inc., Niagara Falls, N. Y. (U. S. No. 1,245,383; Nov. 6, 1917.)

Atomizing Metals—Process for Atomizing Metals in a State of Fusion. Florencio Comamala Ucar, Madrid, Spain. (U. S. No. 1,245,536; Nov. 6, 1917.)

Car-Dumping Apparatus. George Henry Mueller, Columbus, Ohio, assignor to the Jeffrey Manufacturing Co. (U. S. No. 1,245,947; Nov. 6, 1917.)

Cement—Manufacture of Acid and Waterproof Cement. Curtis C. Meigs, Philadelphia, Penn., assignor to Electro-Chemical Supply and Engineering Co., of Philadelphia, Penn. (U. S. No. 1,245,608; Nov. 6, 1917.)

Dump Car. Jay B. Rhodes, Kalamazoo, Mich., assignor to Western Wheeled Scraper Co., Aurora, Ill. (U. S. No. 1,245,382; Nov. 6, 1917.)

Heat Value of Gas—Method of and Apparatus for Testing Gases. George G. Crewson, Tottenville, N. Y., assignor to the Roessler & Hasslacher Chemical Co., New York, N. Y. (U. S. No. 1,245,688; Nov. 6, 1917.)

Metal Treatment—Apparatus for Treating Metals and Their Alloys. Alvin M. Craig, New Haven, Conn. (U. S. No. 1,245,687; Nov. 6, 1917.)

Mold. Solomon Swetzoff, Boston, Mass. (U. S. No. 1,245,636; Nov. 6, 1917.)

Openhearth Furnace. Thomas S. Blair, Jr., Chicago, Ill., assignor to Blair Engineering Co., New York, N. Y. (U. S. No. 1,245,555; Nov. 6, 1917.)

Ore Concentrators, Feeding Appliance for. Edward J. O'Connell, Fort Wayne, Ind., assignor to Deister Concentrator Co. (U. S. No. 1,245,611; Nov. 6, 1917.)

Pulverizing Molten Materials, Method and Apparatus For. Wood Freeman, Tacoma, Wash. (U. S. No. 1,245,328; Nov. 6, 1917.)

Pyrites—Method for Treating Burnt Pyrites and the Like. Edgar Rouse Sutcliffe, Leigh, England. (U. S. No. 1,245,634; Nov. 6, 1917.)

Rotary Boring Drill. Howard R. Hughes, Houston, Tex., assignor to Hughes Tool Co., Houston, Tex. (U. S. No. 1,245,462; Nov. 6, 1917.)

Soldering Compound for Various Metals. William Brierly and Nelson R. Moore, Vanderbilt, Penn. (U. S. No. 1,245,862; Nov. 6, 1917.)

Editorial Correspondence

SAN FRANCISCO—Nov. 17

Seventeen New Oil Wells were started during the week ended Nov. 3; 14 of these are in Kern County fields, one in Montebello field near Los Angeles, two in Coalinga. This makes a total of 879 new wells started since the beginning of the year. In the week, 15 wells reported for test of water shut-off, 21 deepening or redrilling, and three abandoned. In the week ended Nov. 10, the State Mining Bureau reports 16 new wells started, making the total 895. Seven of these new wells are in the southern fields, one in Santa Maria, four in Kern County and four in Coalinga. Twenty-three wells were reported for test of water shut-off, 14 for deepening or redrilling, and six had been abandoned.

Dry-Land Dredge Near Igo, installed a few years ago, has been dismantled, the machinery sold to L. Gardella who is operating dredges on Clear Creek; the motors and other electrical appliances sold to the Northern California Power Co. Creditors received $2064 to satisfy claims of $6950, or equivalent to 31c. on the dollar. This dredge was constructed on a plan which provided for a digging machine, or steam shovel, separate from the washing machine. The washing machine consisted of a revolving screen and gold-saving riffled tables, the whole made portable by being set upon two four-wheel trucks. Both the digging and the washing machines could be moved wherever desired and the water and electricity supplied from near-by plants. The machine was first introduced in Butte County near Oroville. In that operation the gravel was dug by a Marion steam shovel. The theory of washing the gravel was attractive but it was evident that either the digging cost was too great or the yield was too poor to provide a profit on the venture as results have showed.

Atolia-Randsburg Tungsten District is again attracting the attention and active efforts of tungsten miners who apparently have come to the conclusion that whether prices remain high and firm or may vary during the coming year or two, it is better to do their development work thoroughly and with the view of permanency and preparation for continued operation. But in the past there has been too much of the boom spirit in the districts surrounding Atolia and Randsburg, and this disposition to get all there was to be got during the early days of the tungsten boom when prices were high, has caused Randsburg and Atolia a good deal of trouble. Of course, there is a little excitement just now over the fact that a piece of scheelite weighing about a ton and showing a high tungsten assay was extracted whole from the 800-ft. point in the Churchill No. 1 of the Atolia Mining Co.'s property. The disclosure of so large a piece of tungsten ore at that depth in a mine, which is practically flat on the desert, is so rare that it forms the subject of a great deal of comment. It is probable that this disclosure indicates the persistence of scheelite at depth in the Atolia mines, though this theory is by no means established. However, it is encouraging to prospectors and miners who are now more inclined to extend the permanency of the camp to the surrounding portions of the district. The small properties which have been mined for the surface ores are now being deepened or extended with the view of determining whether or not there are other extensive orebodies in the district. The Gypsy group, the Nixon lease and the White Flower, the Windy Weather, Easter and neglected fractions are being developed by F. J. Abbott of Los Angeles. The Atolia Junction new shaft is down 110 ft., the bottom looking good; development of 75-ft. level, 15 ft. east of the shaft disclosed a strong vein believed to be the continuation of the Paradox, exposed on the Atolia, a few hundred feet east. In the Gypsy main shaft at the bottom, three veins show tungsten streaks between quartzite; the country rock is gray granite and the vein matter identical with that which marks the surface working of the Union and Churchill on the north and west. In the Gypsy group, the vein filling is reported by F. J. Abbott, mining engineer, to be exposed for a width of 12 ft., with a dip of 40° to the north. The hanging wall is horn-blende granite and the foot wall, granite. Generally speaking, the brief description of the Gypsy group may apply to the eastern extension of the belt of granitic rocks that may be followed across the desert toward Searles Lake. Tungsten possibilities have not been prospected extensively along this belt and, in times when the demand for tungsten was limited, few prospectors paid any attention to this section of the country. However, Charles Churchill, who was the discoverer of the Atolia and the other early tungsten claims in the Atolia district, went over this eastern country several years ago and found that there is such an extension of formation which indicates that scheelite may be found across San Bernardino County and into the State of Nevada for some distance.

BUTTE—Nov. 16

Federal Explosive Measure is welcomed in Butte as an effective aid to the local authorities in their attempt to prevent the use of explosives by persons bent on revenge or mere mischief. Heretofore they have been seriously handicapped by the absence of any law to regulate the sale, use and possession of such explosives. By the new Federal act, the police department is allowed to investigate and anyone found with dynamite or ammunition and without a license, will be arrested and liable to a fine of $5000, or one year's imprisonment. Detectives are now out to see merchants and users of explosives and to instruct them in the provisions of the law. It is also expected that this law will do away with the handling of explosives by incompetent persons.

DENVER—Nov. 17

Shipments from Silverton declined in October; they were as follows: Iowa-Tiger, 33 cars; Sunnyside, 28; Summit Mining Co., 14; Koehler Tunnel, 13; Silver Lake Custom Mill and Pride of the West, 12 cars each; Mears-Wilfley Mill and Barstow Leasing Co., 10 cars each; Mayflower Leasing Co., 9; Dives, 7; Highland Mary and S. D. & G., 6 cars each; Big Giant and Vernon, 5 cars each; North Star, Paul Konisko, St. Paul, and Ohio & Oklahoma Leasing Co., 4 cars each; D. & L. L. Co., 3; Congress, Guadaloupe, Tyler & Shepherd, Hero, W. E. Averill, and Frank Hough, 2 cars each; H. S. Thayer, Precious Metals, Alexander, Jackson & Andren, Gold King, Precious Metals Lessees, Barstow Lessees, Kansas City, and Butler & Erdman, 1 car each; total, 210 cars to outside smelters. The following shipments were made from mines of the district to the Silver Lake Custom Mill; Guston Leasing Co., 15 cars; Colorado Metals Co., 3; Butcher & Curtis, Champion Leasing Co., and Butler Mines, 2 cars each; Hermes Mine and Lackawanna, 1 car each; total, 26 cars. The S. D. & G. Leasing Co. shipped 45 cars to the North Star Custom Mill. The total shipments for September were 324 cars of ores and concentrates, of which 59 cars were sent to the North Star mill, 73 to Silver Lake, and to outside smelteries, 189 cars were shipped.

SALT LAKE CITY—Nov. 17

Coal Transportation in the intermountain section is stated to be showing an improvement from week to week. A comparative statement of percentages of increase in hours of operation as to the movement of coal and coke by the railroads here for the week ended Nov. 10, as compared with the week preceding, as prepared by W. W. Armstrong, fuel administrator for this and surrounding states, shows for the Denver & Rio Grande, this railroad being behind the others, largely owing to the heavy movement of troops over its lines and to some bad luck, according to Mr. Armstrong, an increase of 4% in hours operated the week ended Nov. 10 over the week preceding, the operating-hour efficiency being 57%, based on an eight-hour day; the Oregon Short Line and the Union Pacific each showed an increase of 22% in hours operated and an operating-hour efficiency of 98%, based on an eight-hour day. Orders to the railroads to furnish drop-bottom cars for coal, coke and other forms of fuel for such consignees as are able to handle this type of equipment is working out well, and intensive loading, an example of which is afforded in the Union Pacific report of an increase of five tons in coal per car for the week ended Nov. 10 over the same week of 1916, is improving the situation and affording the equivalent of an additional car for every 10 loosely loaded as formerly. Cars are working more mileage, and not standing idle to any appreciable extent. The operation of the Utah Coal route, now assured almost immediately, as the rolling stock begins to arrive, will materially relieve the coal situation. Two of the six large special type engines ordered have been received and the remaining four are due by the end of the month. Of the 1500 gondola dump cars, 1200 have arrived, and the full number will be made up shortly. It is expected that this road will, by the beginning of next week, be carrying coal from the mines of the United States Fuel Co. at Hiawatha for delivery to the Salt Lake route, the Denver & Rio Grande and the Orem electric roads, with which it connects, and which will carry the output further.

WALLACE, IDAHO—Nov. 17

Uncertainties of Excess-profits Tax law have caused the Hecla Mining Co. to cut its regular monthly dividend from 15c. per share to 5c., payable Nov. 20. Like most mining companies, Hecla is "up in the air" as to what its tax will be, but as there is no doubt that it will be heavy, the reduction in the dividend is the first step toward preparation to meet it. Hecla is capitalized for $250,000, divided into 1,000,000 shares of the par value of 25c. The company has paid in dividends, during the 10 months of this year, $1,500,000 and up to two months ago, the market value of the stock was $9 per share. Owing to the uncertainties of the law, and particularly that part of it which undertakes to define "invested capital," it has been impossible to form an estimate with any degree of accuracy as to the amount Hecla will have to pay, but it is expected to be upward of one million dollars.

Star Mining Co. vs. Federal Mining and Smelting Co. case, the hearing of which, before Judge Deitrich, of the United States District Court, began in this city on Oct. 25, closed so far as taking testimony is concerned on Nov. 3. Judge Deitrich will hear the argument on Dec. 3 at Coeur d'Alene. The contention of the respective litigants as developed in the trial is substantially this: The Federal company admitted in the beginning that in the operation of the Morning mine it had removed some ore from the ground within the boundaries of the Evening Star claim, but maintained that in doing so it was acting within the law of extralateral rights, and that the vein from which the ore was extracted has its apex on the Grouse and Iron Crown claims, owned by the Federal company, in substantiation of which maps and models were submitted, showing practically a continuous raise on the vein to the surface. Against this showing, the Star company contended that the alleged vein that has its apex on the Grouse and Iron Crown is an integral part of the great Evening Star-Morning lode, which projects through the common end line of the Evening Star and Morning claims and which apexes on the Evening Star ground. An excellent model and elaborate maps were submitted in support of this contention.

MARQUETTE, MICH.—Nov. 17

Mine Valuations for Taxation purposes as determined by averaging the stock market prices, have been attacked in a suit originally started in 1915 and now being tried. In 1915, F. W. Denton, then general manager of the Copper Range Consolidated mines, protested against the valuation placed on the Baltic mine, one of its subsidiaries. Mr. Denton was supervisor of Adams township at that time. He continues as supervisor of the township, although he is not now general manager of the mines but is still connected with the corporation as consulting engineer and a director. The valuation which he placed on the Baltic mine, as assessing officer of the township, was increased by the equalization committee of the board of supervisors by $2,200,000. This action was sustained by the board and later by the state tax commis-

sion, when Mr. Denton appealed to that board. Then he started suit, which is being tried before Judge O'Brien, both sides waiving the jury. The case is fairly certain to go to the Supreme Court. The amount of taxes involved is $56,021, paid by the Baltic under protest. The peculiar feature of the present suit is that the directing head of the corporation has an action in court against the township of which he is supervisor. The case has aroused general interest because of the fact that a decision in favor of the Baltic company not only would throw out all of the taxes of 1915 in the county, but would make necessary a change in determining mine valuations. Attorney Stone, in his opening statement for the Copper Range—the Baltic mine having since gone out of legal existence—said that market valuations were not dependable for taxation purposes. Claim is also made that Osceola and Calumet townships were undervalued. St. Mary's Canal company, half owner of the Champion mine, included in the Copper Range, is an intervening party to the suit. Mr. Denton contended that in 1915 each square foot on the dip of the Baltic lode, extending through the thickness of the lode, contained 30 lb. of copper, and that the life of the mine was 10 yrs. Mr. Denton, Manager MacNaughton, of the Calumet & Hecla, chairman of the equalization committee, and several of the supervisors were witnesses. Stone, Wieder & Schulte, of Houghton, and D. H. Ball, of Marquette, represented the plaintiff; Rees, Robinson & Petermann, of Houghton, the St. Mary's Mineral Land Co. and South Range Mining Co., as intervening defendants; M. T. Sherwood, of Marquette, Adams township, and T. B. Baillie, of Lansing, the state tax commission. Judge O'Brien reserved decision.

JOPLIN, MO.—Nov. 17

Home for Mine Operators' Club of the Oklahoma section of the district of a temporary character has been nearly completed at Picher, Okla., and the first meeting will be held there this week. It is planned to have 200 operators pay $25 each to erect a permanent club house on top of hill known as Blue Mound.

Eagle-Picher Lead Co. Smeltery at Galena has had its capacity doubled, and the plant is now the largest of its kind in the world. There are now eight furnaces instead of four, and between two and four million pounds of ore can be handled weekly. In place of the four 5-ft. goosenecks formerly used, there are now eleven 4-ft. goosenecks and a cyclone. The bag room did not require enlargement. Several new fans have been installed, and also several improvements in the way of providing comfortable and sanitary change rooms for the employees.

Drainage of Sheet Ground in North Webb City field is being considered. Since so many of the companies operating in this section have closed down, it is feared the burden of keeping the ground free from water will be too heavy for those that remain. Consequently a movement is on whereby the landowners interested will pay for the installation and operation of a battery of pumps with the idea of draining the ground at a greatly decreased cost over that of the pumping plants now operating.

HIBBING, MINN.—Nov. 16

Taxes on Iron Mines will be increased despite record-breaking shipments of ore during the past year from this state. The assessed valuation of mining properties for 1917 is $18,021,697 higher than in 1916, as determined by the Minnesota Tax Commission. This is the largest increase ever made by the commission in any one year with the exception of 1907, the year of the organization of the commission, when the 1906 assessment of $64,486,409 was increased to $194,428,298. As announced by the commission, the total assessed value for 1917 is $295,353,692, as compared to $277,331,995 in 1916. In accordance with the classified assessment law in 1913, iron ore, mined or unmined, is assessed at 50% of true and full value.

Known Tonnage of State Mines according to the Minnesota Tax Commission will amount to 146,298,952 tons. The total known tonnage of all ore lands in the state, according to the commission, is 475,620,233. This total includes all unmined ore, both that in mines owned by mining corporations or private parties, and that in the mines owned by the state. The state-owned iron mines are on state lands, that is, on school, university and swamp lands belonging to the people and held in trust for them. The state does not operate its own mines but leases them for 50 years duration at a royalty of 25c. per ton. At present there are 97 state mineral leases in force. On 50 of these, merchantable ore has been developed, on eight others ore has been found in large deposits, but not of commercial grade, and on the remainder little or no development work has been done. The size of the leases runs from 160 acres, the largest, to the smallest, which is 36¼ acres. Of the 50 leases on which merchantable ore has been discovered there are still a dozen which have yet to be developed into mines. The total output of all the state-owned iron mines, from the time of the enactment of the mining-lease law in 1889 up to date, is about 18 million tons. The largest shipper is the Missabe Mountain mine at Virginia, with a record of three million tons, closely followed by the Leonidas, Grant and Poole mines, each of which has produced over two million.

EL PASO—Nov. 17

Conditions in Chihuahua are much upset and plans formulated by the American Smelting and Refining Co. for reopening its properties are discarded for the present at least, and no idea can be had when they can be put into effect. The reason presumably is the activity of Pancho Villa and his followers. The Villistas are in control of the district to such an extent that it is declared resumption of operations now is impossible. The Mexican committee which arrived in this country for the purpose of purchasing gold is expected to be reinforced by Luis Cabrera, whose arrival is shortly expected from Mexico. This committee has no official status according to a statement given out by the Mexican Embassy in Washington.

TORONTO—Nov. 19

Royalties on Flotation Process charged by the Minerals Separation North American Corporation, against which complaints have been made by Cobalt mine owners, will be investigated by the Patent Branch of the Canadian Department of Agriculture. It is understood that the mine owners were advised to ask for this investigation without pressing the charge that alien enemies were interested in the Minerals Separation corporation or its patents.

Labor Situation in the Northern Ontario mining camps, especially Porcupine, is steadily improving, many workers being attracted by the high wages paid and the prospect of steady employment. The enforcement of conscription, which is severely felt in some other industries, has little effect as regards the mines, as a large proportion of the laborers are Germans, Austrians or other alien enemies, who are not subject to the draft. It is believed that production has reached its lowest point and will henceforth show improvement.

Exports of Canadian Raw Asbestos to Great Britain, as reported by J. E. Ray, Canadian Trade Commissioner at Birmingham, England, show remarkable increases of late years in both quantity and stated value. In 1902 the imports were 74,043 cwt., valued at $200,750, and in 1916 they had advanced to 244,932 cwt., valued at $922,590. The high mark, however, appears to have been reached in 1915, with a total quantity of 349,863 cwt., of the value of $1,048,500. The aggregate imports of 1916 into Great Britain from all sources, were the highest on record, being 534,237 cwt., valued at $2,687,000. The main source of supply continues to be the Canadian mines, though supplies from the United States, Portuguese East Africa and the Cape of Good Hope have considerably increased.

The Mining News

ALABAMA

Calhoun County

ALABAMA (Gadsden)—Repairing North Gadsden furnace to put second stack in operation by spring; capacity being increased from 400 to 450 tons daily; $200,000 expended.

Jefferson County

WOODWARD IRON CO. (Woodward)—Erecting modern emergency hospital at its red-ore mines, near Bessemer.

INDIA GRAPHITE CO. (Birmingham)—Incorporated with authorized capital of $125,000. W. A. Watts, president and treasurer; W. S. Douglas, vice president; D. W. Inman, secretary.

ALASKA

COPPER SHIPMENTS from Alaska in October amounted to 2[illegible]541 tons of ore, containing 10,763,500 lb copper.

CANADIAN KLONDYKE MINING (Dawson)—Temporary receiver appointed. Judgments were obtained against company for default in payment of bond interest and also for construction supplies. F. P. Burrell, of Dawson, an engineer, has been appointed by court to make inventory of assets.

ARIZONA

Gila County

GIBSON CONSOLIDATED COPPER (Miami)—Organized to purchase Gibson mine; property consists of 16 claims, covering 300 acres. Developed to 500-ft. depth and lateral work is reported as extending 23,000 ft., with considerable tonnage of ore exposed.

Maricopa County

QUEEN CREEK COPPER (Phœnix)—Report of Sept. 29 shows development work consisting of 2487 ft. of diamond drilling and shaft 256 ft.; crosscutting.

Yavapai County

UNITED VERDE (Jerome)—Production for October estimated at 7,350,000 lb. of copper; expects to increase this amount in November.

UNITED VERDE EXTENSION (Jerome)—Shipments of copper ore decreased slightly in October, owing to car shortage; production may reach 6,000,000 lb. of copper in November.

CALUMET & JEROME (Jerome)—Established record footage in October for crosscuts, drifts, etc. Grade of ore from winze improving and crosscut will be made at 80 ft. instead of 100 ft. unless conditions change.

ARKANSAS

Marion County

CAR SHORTAGE on White River division of Missouri Pacific and Missouri & North Arkansas prevents full production of the field being moved. Relief in sight in December after cotton crop is moved.

A. & S. C. (Rush)—Remodeling mill and increasing capacity.

LONNIE BOY (Rush)—Three tunnels being driven show rich run of blende and carbonate. Drilling machinery installed.

BEULAH (Rush)—Lately taken over by Continental Mining Co.; milling plant half completed. Work underground will start soon.

Searcy County

MAYS-REDWINE (Marshall)—N. Howard, of Treese, La., purchased Mays-Redwine mine near here. Also purchased Evening Star-Churchill mines. Shipped four cars recently; three more awaiting shipment; producing high-grade zinc carbonate.

CALIFORNIA

Amador County

HARDENBERG (Jackson)—Mine closed down, after opening of small rich orebody. Undecided regarding future development.

Calaveras County

ANGELS MINING CO. (Angels Camp)—James V. Coleman, manager and owner, developing property on Democrat Hill, west of the Mother Lode. New two-compartment shaft down 70 ft. on vein. Formerly, gold nuggets were mined on surface.

Eldorado County

IN THE NASHVILLE DISTRICT the Montezuma mine will have stamp mill; development by 1000-ft. shaft and drifts north and south at 100-ft. points below 500 ft. J. C. Heald, owner. Havilla, south of Montezuma, developed by San Francisco men who are reconstructing stamp

mill. Washington and California Co., of Seattle, starting work on Mother Lode property; recently developed 5-ft. vein of good ore. Grant Busick property, north ot Nashville, being developed by Anthony Crafton for Seattle men, who have option.

Inyo County

IN REVENUE CANYON DISTRICT the Revenue copper mine is being developed. Trail being opened in Knights Canyon district and when completed will commence work. Reported high-grade copper ore opened by H. J. Robinson. Silver and lead properties on north and east of Revenue attracting attention. Reported that A. E. Glace, geologist, recorded some locations. Several men from Trona will work silver prospect on northeast side of canyon when supplies received. In Snows Canyon, reported Jack Cress completed transfer of St. George mine to New York men; ore is gold.

MINNIETTA (Johannesburg)—In operation after being reorganized and making repairs, while motor trucks were unavailable for hauling ore to Trona.

ROUND VALLEY TUNGSTEN CO. (Bishop)—Shipped 20 tons tungsten concentrates last week in October. Building new bunkhouse 32 x 44 ft.; some portable buildings being received.

Los Angeles County

UNION OIL CO. (Los Angeles)—Montebello well No. 1, brought in Nov. 1, at depth of 2050 ft.; flowed at rate of 1100 bbls. an hour, but being adjusted for pumping. Oil is 22 gravity. Situated within 1000 ft. of Standard gusher, recently brought in; latter was first in the field and was believed to be evidence of a gusher district.

Nevada County

NORTH STAR MINES CO. (Grass Valley)—Reported full force of men underground in Champion mines of Deer Creek; 40-stamp mill completed. Concrete concentrating floor put in and cyanide plant has been enlarged.

Sacramento County

CALIFORNIA POTASH CO. (Sacramento)—Authorized to exchange 24,999 shares with Edwin Oliver for formula for manufacture of potash and for transfer of contract for extraction of potash from municipal incinerator with the city of Sacramento.

Solano County

ST. JOHN QUICKSILVER (Vallejo)—Old brick condensers being dismantled and replaced by modern wooden type. Bricks being broken up and run through furnace; estimated they will yield about 100 flasks of quicksilver.

San Bernardino County

OZARK (Victorville)—Treating 50 tons of ore a day successfully.

San Francisco County

WESTERN FUEL CO. (San Francisco)—Reported that in accordance with Government's prices on coal from Utah, Wyoming and New Mexico, this company will refund overcharges innocently made.

PRESIDIO MINING CO. (San Francisco)—Demurrer denied by court in case brought by W. S. Overton for removal of Wm. S. Noyes and directors and $2000 damages. Case will now go to trial.

Shasta County

AFTERTHOUGHT (Ingot)—During run of flotation plant, concentrates hauled by motor truck to Bella Vista and shipped by rail; zinc to Oklahoma and copper to Tacoma; was first production since 1900, when mine shut down because of inability to treat copper ore with large zinc content. Flotation solved problem; ore reported to be 8% copper and 44% zinc.

Storey County

JACKET (Gold Hill) — Surface tunnel raise extended 15 ft. and 27 cars low-grade ore saved. Mill working with new equipment; ball mill and tables operated 111 hours during week; old cyanide plant operated; 322 tons of ore put in mill bins.

OPHIR (Virginia)—Reopened old main lateral drift on 2000-ft. level; 618 ft. now in repair. On 2100-ft. level extracted four tons, sampling $11.23, face showing 14-in. quartz, sampling $18. Extracted five tons, sampling $6 from west crosscut No. 2. Ore shipped to Mexican mill.

UNION (Virginia) — Drifts on 2300-ft. level extended; saved 47 tons of ore, sampling $21. On 2400-ft. level, 67 tons of ore extracted, sampling $31.60; high-grade streaks near hanging wall exposed. In another crosscut 111 tons of ore extracted, sampling $21.60. Ore saved in cutting out for ore chute was 138 tons, sampling $22.10 at one point, and 137 tons from another point sampling $10.75.

COLORADO

Boulder County

CONSOLIDATED LEASING CO. (Eldora)—Mill being constructed.

UP TO DATE (Boulder)—Will be operated all winter.

DANA MINING CO. (Boulder)—Will reopen Hoosier mine, near Summitville, an old silver producer.

Chaffee County

STONEWALL (St. Elmo)—This old lead mine being reopened.

PARAMOUNT REDUCTION CO. (St. Elmo)—Mill resumed operations with new steam engine. Treating custom ore from Flora Belle, Molly and other mines.

Clear Creek County

ARGO LEASING CO. (Idaho Springs)—Building 50-ton mill.

SCEPTER TUNNEL (Idaho Springs)—Main adit retimbered and raise completed to Sunburst adit. Considerable good-grade ore opened. Aerial tramway, 6000 ft. long, to railroad to be built, and electric-driven compressor to be installed.

PRIMOS CHEMICAL CO. (Empire)—Grading for new 200-ton molybdenum mill at Camp Boericke. Treatment will consist of crushing, grinding in ball and tube mills, and concentration by flotation. Main adit in 500 ft., will be driven 2000 ft. Aerial tramway to be used until adit completed, when electric haulage will be used.

Gunnison County

BRANDT INDEPENDENT (Gunnison) Will resume driving of tunnel.

IDA MAY (Pitkin) — Sold recently to Rare Metals Production Co., of Denver, with plants at Rollinsville and Utah Junction. Developing. Molybdenum and tungsten ores to be produced.

Lake County

LACKAWANNA BELLE (Twin Lakes)—Good-grade ore opened in development.

FIDELITY MINING CO. (Twin Lakes)—Contracted for driving tunnel.

ANCHOR (Twin Lakes)—Lease and bond taken by Denver men. Developing.

SILENT FRIEND (Leadville)—Lessees opened lead-zinc sulphide ore; shipping 50 tons daily.

GREEN BACK (Leadville)—This Graham Park property again operating to full capacity.

LINCOLN HIGHWAY (Granite) — Being developed. Surface showing of gold ore is good. Plan to build 20-ton mill next spring. M. D. Gilder and Harry Huntley, of Cripple Creek, owners.

La Plata County

SAN ANTONIO TUNNEL AND MINING CO. (Bayfield)—Recently incorporated with capitalization of $3,000,000. Company owns 200 acres above Emerald Lake.

Park County

KANSAT (Montgomery) — Good-grade gold ore being shipped.

SHELBY (Alma)—Being worked by lessees.

WHEELER (Alma) — Lessees shipping ore.

Summit County

MINNIE (Breckenridge)—Lessees shipping lead-silver ore.

ELLA (Breckenridge)—Shipments of oxidized lead-silver ore being made.

GOVERNOR (Breckenridge)—Reopened by leasing company.

WELLINGTON (Breckenridge)—Steam-heating plant for boarding and bunk houses to be installed.

BUNKER HILL (Breckenridge)—Being worked by lessees. Shipment of oxidized ore made.

IRON MASK (Breckenridge)—Shipping carbonate and sulphide ores. Operated by Midwest Metal Mining and Holding Co

BALD MOUNTAIN (Breckenridge)—Operating Carbonate mine, making shipments of gold-silver-lead ore. Tunnel will be driven to cut vein at greater depth.

Teller County

AJAX (Victor) — Lessees making shipments.

CAMP BIRD MINING, LEASING AND POWER CO. (Cripple Creek)—Sinking Rose Nicol shaft, now 800 ft. deep.

GOLD DOLLAR (Cripple Creek)—Lessees shipping from Mable M shaft, on Beacon Hill.

OCEAN WAVE (Victor)—Shaft is 350 ft. deep. Lateral development when 400-ft. level is reached.

MODOC CONSOLIDATED (Victor) — Good-grade ore broken on 11th and 15th levels of old incline shaft. Production curtailed until new vertical shaft ready.

EXCELSIOR MINING AND LEASING CO. (Denver)—Sinking shaft now down 575 ft. Development will be done on 500- and 600-ft. levels to connect oreshoots opened from same levels of Golden Cycle shaft.

UNITY MINING AND LEASING CO. (Cripple Creek)—Operating south one-half of Nightingale claim under long-term lease from Stratton's Cripple Creek Mining and Development Co. Vertical shaft now down 450 ft., will be sunk to 800 ft. level, working two shifts.

ROOSEVELT DRAINAGE TUNNEL (Cripple Creek)—Drifting north in Funeral dike toward Cresson mine. Drift is in Big Banta claim of United Gold Mines Co., and will connect with Cresson workings. Tunnel will be continued across Portland territory; heading is now beyond Rose Nicol shaft.

IDAHO

Shoshone County

EAST CALEDONIA (Wardner)—Shaft being sunk 200 ft. from 400-ft. level. Exploration of 200-, 300-, and 400-ft. levels shows improvement in ore. Property is equipped for development, electric power being used for all purposes.

JACK WAITE (Murray)—New ore shoot in raise from upper tunnel. Shipping average of 300 tons per month, hauling 10 miles to railroad. Ore averages 50% lead with low silver contents. Contemplates building mill in spring from treasury surplus.

RED MONARCH (Wallace)—Reported encountered 3 ft. of shipping ore in east drift from long crosscut tunnel. Vein is 40 ft. wide with considerable zinc-lead ore of milling grade. Crosscut beng extended to second vein now in over 3000 ft. Electric motors will soon replace mules.

NATIONAL (Mullan) — Mill started on Oct. 14, at half capacity. Shipped six carloads of concentrates; expects to ship two more by end of first month. Ore averages a little above 1% copper and about 3 oz. of silver. Concentrates run 20% copper and 55 oz. of silver. Operations a year ago proved unprofitable. Since, an orebody has been opened on 1500-ft. level of better grade. Has modern mill of 500 tons capacity, using flotation.

KANSAS

IN OIL FIELDS of Butler County, 50 I. W. W. workers were arrested on Nov. 20. It is stated this is the initial step by state and Government officials to round up 3000 members of the organization. Another raid is planned in Towanda and Eldorado fields.

MICHIGAN

Copper

HANCOCK (Hancock) — Has lost some trammers; tonnage will show falling off.

WYANDOT (Houghton)—Stockpile will be sent to Winona mill during first half of December.

FRANKLIN (Demmon)—The 30th level on Pewabic amygdaloid lode is in north 1300 ft.; last 400 ft. showing good copper.

MAYFLOWER-OLD COLONY (Houghton)—Replaced hand drilling with three air drills in sinking shaft.

WINONA (Winona) — Shipping nearly 400 tons daily, taking some rock from Nos. 3 and 4, the hoisting crew being transferred.

NEW ARCADIAN (Houghton)—Passed through hanging-wall branch of New Arcadian lode; heavy copper in width of 8 ft.; expect to strike main lode within a few feet.

SENECA (Calumet)—Construction work advanced rapidly, being favored by two weeks of good weather; last concrete for machinery poured Nov. 16; sinking will start in another month.

OSCEOLA (Osceola)—Loss of trammers will cause drop in tonnage. Tailings sands have extended so far into Torch Lake that a pumping station is being built to carry them out into lake for years to come.

SOUTH LAKE (Lake Mine) — Special meeting on Dec. 14 to authorize doubling present issue of stock to 200,000 shares, par value, $25, to purchase SW¼, Sec. 30, the northern extension of mine. New issue will be sold to stockholders.

CALUMET & HECLA (Calumet)—Contracted with W. J. Gleason & Co. of Aitkin, Minn., to excavate drainage canal, 3000 ft. long and 20 to 30 ft. deep, in Swedetown Swamp, west of mine, and over its workings into which water seeps, causing expensive pumping. Water will go into regular sewer system.

Iron

PLYMOUTH (Wakefield)—Reported will be taken over Jan. 1 by recently organized Plymouth Mining Co.; Pickands, Mather & Co. will operate and sell the ore. Lackawanna Steel Co., Youngstown Sheet and Tube Co., Midvale Steel and Ordnance Co., Steel Co. of Canada, and Allan Wood Iron and Steel Co., interested.

HUMBOLDT DISTRICT is showing activity. Exploration has been commenced

at Hungerford property by the Williams Iron Co. Two boilers, small hoist and small compressor installed, pumps lowering water in shaft, small shaft house and ore and rock trestles have been built, three buildings are up and making preparation for underground work. Captain Peck, of Marquette, is in charge. This is the only company on Marquette range which made public sale of stock, other companies being close corporations.

MINNESOTA

Mesabi Range

HOLLAND (Biwabik)—Stock pile accumulated three years ago by local men being loaded by steam shovel and shipped to Two Harbors Docks.

RUDDY (Biwabik)—Owned in fee by Yawkey estate of Detroit being reopened by Michigan men after two years of idleness. New shaft to be sunk on western side.

BALKAN MINING CO. (Coleraine)—Opening Washoe mine near here; received permission from county commissioners to remove part of road between Bovey and Taconite, providing new road is constructed to serve same purpose.

OLIVER (Hibbing) — Announced by Duluth officials that on account of orebody underlying part of village, north of Great Northern Ry. tracks buildings will be moved. Company is purchasing buildings in this section and platting a new addition to Hibbing near the suburb called Alice.

MISSOURI

Joplin District

JAMOT BROWN (Joplin)—Will reopen Rebecca mine, west of Chitwood.

BEN B (Joplin)—Completed 150-ton mill on 40-acre lease west of A. W. C. plants. To operate two shafts; ore at 150 ft. O. Longacre, Joplin, owner.

ONCE MORE (Joplin)—Homer Seals has taken lease on this sheet-ground property, west of city, and will operate. Repairing mill; will sink shaft deeper.

TULSA-SAPULPA-MIAMI ASSOCIATED (Miami, Okla.)—Sinking shaft in new territory, near Wyandotte, Okla. Drilling indicated ore run at 150 ft.

BLACK EAGLE (Quapaw, Okla.)—Will build 300-ton mill on lease just east of St. Louis, Okla. Tract has just been thoroughly drilled; orebody with 30-ft. face proved.

COAHUILA LEAD AND ZINC (Webb City)—Have taken leases and starting drill prospecting on virgin lands east of Waco, Okla.

TENNESSEE (Joplin)—Sinking new shaft, north of mill, at Klondike. Will connect with present field shaft by surface tramway. Drilling shows indications of rich ore.

CARTER COUNTY LEAD AND ZINC (Joplin)—Will build 400-ton mill on American land, near Smelter Hill, northwest of Joplin, following drilling campaign. M. G. Brady, Joplin, manager.

MISSOURI ZINC (Joplin) — Renewed lease for 10 years on Quick Seven mine at Neck City. Acquired also Lost Indian lease. Quick Seven mined as open-cut property all year successfully.

ONAMENA (Webb City)—Two of three plants at Duenweg shut down, but getting good results from No. 4 mill, recently started in operation. Ore running about 3% and giving high-grade concentrates.

LIVE WIRE (Joplin)—Purchased from H. E. Gerke, of Joplin, by company of Tulsa oil operators. Shaft on this lease is in new territory, southwest of Joplin, encountering ore at 135 ft. Reported consideration was $50,000.

MONTANA

Deerlodge County

INDEPENDENCE (Anaconda)—Situated at head of Warm Springs Creek, being worked by leasers; three carloads high-grade copper ore ready for shipment when enough snow for sleighing. Recently located by Robert Lindberg of Anaconda.

Fergus County

BARNES KING DEVELOPMENT (Kendall)—Report for quarter ended Sept. 30 shows final payment on Shannon option, amounting to $61,442, leaving treasury balance on June 30, amounting to $124,374. Bullion from North Moccasin was valued at $53,739; from Piegan-Gloster, in Lewis and Clark County, $48,587; from Shannon, $177,071. Results of October operations as follows: Bullion from North Mocassin, $18,000; from Piegan-Gloster and Shannon, $52,000.

Lewis and Clark County

COFFEE-BYRNES (Helena) — Shipped two carloads silver ore averaging $2.50 per ton.

HELENA (Helena) — Shipped 21 carloads; smelter returns about $18,000.

MARYSVILLE GOLD SYNDICATE (Marysville)—Acquired Bald Mountain and Belmont mines. Agreement with Marysville Gold Co. for milling 30 tons a day. Syndicate financed in Duluth, Minn.

Silver Bow County

VANDOR MINING CO. (Ringling)—Filed articles of incorporation Nov. 9, with recorder of Silver Bow County. Capital stock of $50,000 divided into shares of $1 each. Object is a general mining business. Directors are James Dougherty et al.

ANACONDA (Butte)—On Nov. 13 over 9100 miners at work hoisted 12,544 tons, of which 793 was zinc ore. Never-Sweat mine started operations Nov. 12 with 345 men; expect immediate operation of Tramway mine, where crew was engaged in fireproofing shaft recently. On basis of normal force of 10,500 men, company is now working at nearly 86%.

NORTH BUTTE (Butte)—Filed notice Nov. 14 with clerk of district court, stating intention to move for judgment on pleadings in several damage suits resulting from fire on June 8 last. Because of similarity of cases only one will probably be argued as a test case. Company claims compensation laws fully covers its liability.

NEVADA

Nye County

TONOPAH ORE PRODUCTION for week ended Nov. 10 was 9901, valued at $173,267, comparing with 10,223 tons the previous week. Producers were: Tonopah Belmont, 2438 tons; Tonopah Mining, 2500 tons; Tonopah Extension, 2380 tons; Jim Butler, 850 tons; West End, 1154 tons; MacNamara, 487 tons; Halifax, 54 tons; Belle-helen, 38 tons.

MANHATTAN CONSOLIDATED MINES (Manhattan)—Exposed east orebody from 4th level; east drift extended 200 ft. from shaft encountered blue crystalline limestone, which is the footwall; at point 175 ft. from shaft started south crosscut to tap orebody.

UNION AMALGAMATED (Manhattan)—Working two shifts in raise extended from 600-ft. level to connect Earl shaft; advanced total of 37 ft. above level; expect to hole through in about 12 days. Three shifts employed in Earl shaft; 84 ft. of shaft enlarged and repaired.

OREGON

MANGANESE PROPERTIES in Lake Creek district, north of Medford, have been purchased by the Manganese Metal Co., of Tacoma, Wash.

GOLD RIDGE (Gold Hill)—This gold and silver mine, three miles west of here, on Kanes Creek, leased by Clarke & Webb of Medford. Operating a three-stamp mill; developing 20-ft. vein.

RED OAK (Gold Hill)—This gold mine, three miles southwest of here, on Galls Creek, being reopened by John Ralls and Claude Lawrence. Produced $40,000 from 60-ft. level, 25 years ago; idle since on account of litigation. The 300-ft. level will be reopened.

UTAH

Juab County

CHIEF CONSOLIDATED (Eureka)—Report for quarter ended Sept. 1 shows 13,075 dry tons of ore—9592 tons, lead; 3215 tons, other ore; and 268 tons, zinc produced, for which $414,850 received after payment of smelting charges, freight, and sampling. Net profit for period was $96,041. Content of ore was: Gold, 2458 oz.; silver, 382,802 oz.; lead, 2,083,587 lb.; zinc, 194,508 lb. Production decreased by inability of smelters to take entire possible output.

Salt Lake County

UTAH COPPER (Bingham) — October production estimated at 18,100,000 lb. copper.

SELLS (Alta)—Material for new tramway received, and work on line begun. Expected to begin operating in December. Shipping two cars weekly.

EMMA CONSOLIDATED (Alta)—Molybdenum sulphide ore opened; making arrangements for treatment. Other Alta properties have ore carrying molybdenum, among them the Alta Gladstone.

COLUMBUS-REXALL (Alta) — During three months shipped 35 cars or about 1900 tons; net monthly profits about $10,000. Considerable difficulty from labor, haulage, etc., besides work of putting up new buildings for winter operation.

WEST TOLEDO (Alta)—Main Frederick tunnel in 3000 ft.; drifting to east at 2200 ft. from portal. Drifting for Flagstaff or Haskell fissure; some manganese encountered. According to A. L. Jacobson, manager, expects to have power drills at work in two places in November.

MONTANA-BINGHAM CONSOLIDATED (Bingham)—Control of Fortuna acquired through sale of treasury stock. Capitalization, 3,000,000 shares, par value, $1; $240,000 set aside for redemption of bonds and payment for Tiawaukee and Valentine properties. Controls also Montana-Bingham ground and large drainage and development tunnel, in which electric railroad to be installed. C. G. Valentine, of Honolulu, president and managing director; L. R. Eccles, of Ogden, vice-president; John Pingree, president Merchants Bank, Salt Lake City, treasurer.

Tooele County

MONOCCO (Gold Hill)—Lessees shipped first car during week ended Nov. 9, and another expected soon. Ore from surface workings carries copper.

SEMINOLE COPPER (Gold Hill)—Recent shipment was high in tungstic acid; preparing for another shipment of similar ore and one of molybdenum ore. Fifty-ton mill recently purchased to treat low-grade tungsten ores on property.

Utah County

BELLEROPHON (American Fork)—Ore successfully tried out in new Pacific mill of Fissures Exploration, which owns lease.

COTTONWOOD COPPER (Provo) — Articles of incorporation filed Oct. 30. Capitalization, $50,000; shares, par value of 5c. Thomas C. Wright, president.

CANADA

Ontario

NEWRAY (South Porcupine)—Consists of 320 acres; acquired by Crown Reserve Mining Co.

MURRAY MOGRIDGE (Bourkes Station)—Shaft down 224 ft.; timbered to 200-ft. level.

KERR LAKE (Cobalt)—October production amounted to 213,802 oz., being highest record since May last.

BURNSIDE (Kirkland Lake)—Comprising about 120 acres adjoining Tough Oakes, taken over by Aladdin Cobalt Co.

THOMPSON-KRIST (Timmins) — Will be explored by crosscut on 400-ft. level from underground workings of Vipond.

HAYDEN (Timmins)—Diamond drilling reported satisfactory. Depth of 600 ft. reached; intend to drill to 1000 ft.

ASSOCIATED GOLD FIELDS (Larder Lake)—Shaft down nearly 500 ft.; results of last 50 ft. reported satisfactory; capacity of power plant at Raven Falls increased.

CANADIAN KIRKLAND (Kirkland Lake)—At depth of 35 ft. in shaft sunk on main vein, orebody is 16 ft. in width with free gold showing across a 2-ft. width. Another promising vein is 12 ft. in width.

MINING CORPORATION OF CANADA (Cobalt)—Has secured option on gold property recently discovered in Rickard Township. Main vein stated to vary from 20 to 40 ft. in width.

NIPISSING (Cobalt)—Mined ore during October with contents estimated at $306,167, and shipped bullion from Nipissing and custom ore with estimated net value of $335,386.

DAVIDSON (South Porcupine)—Electric power line will be extended through this property. Sulphides in finer state at 300 ft. than on upper levels. Acquired additional claims in Northeast Tisdale, now controlling about 500 acres.

LA ROSE CONSOLIDATED (Cobalt)—Special shareholders' meeting in Augusta, Maine, on Dec. 10 to ratify dissolution of the American holding company to escape American in addition to Canadian taxes; also to reduce capitalization from $6,000,000 to $1,500,000.

WEST DOME CONSOLIDATED (South Porcupine)—Arranging for development of southern end of property through workings of Dome Lake; some Dome Lake veins dip and continue into West Dome ground. Also planning for use by West Dome of part of Dome Lake mill.

MEXICO

NEW DENOUNCEMENTS of mining claims are forbidden in a circular issued to all mining agencies by Alberto J. Pani, Secretary of Commerce and Industry.

SALVADOR

BUTTERS SALVADOR MINES (San Sebastian)—In August, tonnage crushed amounted to 3675, averaging $11.66; tailings loss, $1.69. Value of bullion available for shipment, $36,000; expenses, $28,000; profit, $8000. September tonnage crushed was 3025, averaging $14.77; tailings loss, $1.60. Value of bullion available for shipment, $41,000; expenses, $27,250; profit, $13,750.

The Market Report

SILVER AND STERLING EXCHANGE

Nov.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Nov.	Sterling Exchange	Silver New York, Cents	Silver London, Pence
15	4.7515	85⅜	43⅛	19	4.7515	85⅛	43⅛
16	4.7515	85⅜	43⅛	20	4.7515	85⅛	43⅛
17	4.7515	85⅛	43⅛	21	4.7515	85⅛	43⅛

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Nov.	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
15	*23½	74½	6¼	6.20 @6.25 6.20	7¼ @8 7¼
16	*23½	74½	6¼ 6¼	@6.25 6.25	@8 7¼
17	*23½	74½	@6¼ 6.25	@6.30 6.25	@8 7¼
19	*23½	75	@6.50 6.25	@6.30 6.25	@8 7¼
20	*23½	76	@6.50 6.25	@6.30 6.25	@7¼ 7¼
21	*23½	77	@6.50	@6.30	@7¼

* Price fixed by agreement between American copper producers and the U. S. Government, according to official statement for publication on Friday, September 21, 1917.

The above quotations (except as to copper, the price for which has been fixed by agreement between American copper producers and the U. S. Government, wherein there is no free market) are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars.

We quote electrolytic cathodes at 0.05 to 0.10c. below the price of wirebars, cakes and ingots.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c. St. Louis-Pittsburgh, 13.1 cents.

LONDON

Nov.	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic	Tin Spot	Tin 3 Mos.	Lead Spot	Zinc Spot
15	110	110	125	277	276	30½	54
16	110	110	125	276½	275½	30½	54
17	....	....	....	....	....	....	....
19	110	110	125	276½	275½	30½	54
20	110	110	125	279½	278½	30½	54
21	110	110	125	284½	283½	30½	54

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at $4.7515. £30½ = 6.4696c.; £54 = 11.4545c.; £120 = 25.4544c.; £137 = 29.0605c.; £240 = 50.9089c. Variations, £1 = 0.2121205c.

Metal Markets

NEW YORK—Nov. 21

All of the markets were quiet this week, without any noteworthy features of major character. Lead was firm and dull. Zinc was dull and easy. The spectacular rise in tin continued, but was more nominal than representative of business.

Copper—Under the direction of the Copper Producers' Committee things are moving along very smoothly. There is not at present enough copper to go around. It is certain that the month of November will end with producers owing a great deal of copper that ought to have been delivered. Occasionally some manufacturer has evinced a desire to secure more than his share of copper in order to keep his plant running full, but the Copper Producers' Committee has no favorites and nearly all of the manufacturers have cheerfully recognized the situation that exists and have done their part to make things fair to everybody and as easy as possible.

There is nothing in the agreement between the Government and the producers that prevents the latter from selling copper for delivery later than January, 1918. An interesting feature this week was some selling to consumers for February and later delivery at 23½c.

The National Conduit and Cable Co. in its last circular says: "With cost of producing and marketing copper decidedly increased, it is highly important to stimulate production by permitting all branches of the industry to operate on a profitable basis. Expansion under present rather onerous regulations will be more pronounced when the price permits reasonable profits and the payment of highest wages. It is of utmost importance just now that production be enormously stimulated. If 2 or 3c. a pound more for copper will serve to accomplish this purpose it would be an unwise policy to begrudge an advance that will swing every one of the producing properties into line. War conditions demand an expanding output of copper. Curtailment now would be an egregious blunder, and we go on record as sounding a warning note against the peril that may be involved in going to sleep over the situation."

Copper Sheets are quoted at 33c. per lb. for hot rolled, and 1c. higher for cold rolled. Wire is quoted at 28@29c. per lb. f.o.b. mill.

Tin—The market rose from day to day, but quotations were of nominal character rather than indicative of transactions. In fact, very little, if any, business was done in either Straits or Banka, supplies not being available.

Exports of Bolivian tin ore and concentrates for the nine months ended Sept. 30 included 13,489 tons to Great Britain and 4606 tons to the United States. The shipments reduced to tons of fine tin show an increase of 3400 tons this year.

Sales of Billiton tin in August were 4430 pikuls. Unsold stocks of Banka tin held by the Netherlands Trading Co. on Sept. 30 were 864 gross tons.

Lead—Transactions in this metal dwindled very materially as compared with the previous week. Indeed, the transactions this week were rather light, our reports not amounting to any more than 2000 tons. However, the market, although dull, was very strong and became stronger during the later part of the week, when prices as high as 6¾c. for spot lead in New York were realized on 100-ton lots. The principal producer continued to sell at its published price, 6¼c., but apparently exercised some choice respecting the business it would accept. An interesting feature of the week was some round lots sold to domestic consumers for December-March delivery, this business being booked at 6¼c., New York. The St. Louis market also was strong.

There was an increased demand for antimonial lead. This is sold at the lead value plus the antimony value, both at market prices, less a discount of 0.25c. per lb. from the combined prices. Thus, if the combined prices figure 7.25c. per lb., the price for antimonial lead is 7c. The discount on this alloy ranges from 0.25 to 0.50c. per lb. The use of the minimum discount at present reflects the good demand.

Zinc—This market was very dull and toward the close was just a shade easier. There were sellers at 7¾c. St. Louis for prompt, and 7⅞c. for futures. Conferences among the producers with respect to supplying the Government are still going on.

Sales of zinc dust were made at 13c., f.o.b. works, in the Middle West.

Zinc Sheets—Price of zinc sheets has not been changed. Market is still at $19 per 100 lb. f.o.b. Peru, less 8% discount.

Other Metals

Aluminum—This market continues dull with small transactions taking place at 36@38c. per lb. for No. 1 ingots at New York.

Antimony—Transactions were reported at 13½c. for spot, which we quote as the market. We quote futures at 12½@13c., c.i.f. in bond. The Chinese and Japanese houses continue out of the market.

Bismuth—Unchanged at $3.50 per pound.

Cadmium—This metal is quoted at $1.40 @1.60 per pound.

Nickel—Steady at 50c. per lb., premium of 5c. per lb. for electrolytic.

Quicksilver—Firm at $100. San Francisco reports, by telegraph, $100, firm. Late on Wednesday a sale was reported at $105, this being the first advance in price in several weeks.

Gold, Silver and Platinum

Gold—Shipments of $4,200,000 in gold bars were made to Valparaiso, Chile, on Nov. 15 and 17. It is understood that they were made in settlement for purchases of nitrate of soda.

Silver—Market has been quiet and steady. There is some suspense in the situation owing to the tentative proposition of our Government to take over for a period of six months or more the silver output of our country at 85c. per oz. New York delivery for redistribution for coinage purposes here, in England and in India. Nothing definite has yet developed.

Indian currency reserves at the close of October were 29 crones, 14 lakhs of rupees (291,400,000 rupees) silver, a decrease of 36 lakhs rupees during the month.

Stocks of silver in Shanghai at the end of October were 15,200,000 "dollars" and 25,200,000 oz. sycee; a small increase during the month.

Mexican dollars in New York: Nov. 15, at 65½c.; 16, 65½c.; 17, 65½c.; 19, 65½c.; 20, 65¼c.; 21, 65¼ cents.

Price of Silver, Nov. 8, in London was reported erroneously last week; it should have been 43¾d.

Platinum—In brisk demand, with sales at $105.

Palladium—In good demand at $125@130.

Zinc and Lead Ore Markets

Joplin, Mo., Nov. 17—Blende per ton, high, $73.60; basis 60% Zn, premium ore, $72.50; medium to low, $65@55; calamine per ton, 40% Zn, $35@38; average selling price, all grades of zinc, $57.51 per ton.

Lead, high, $76.30; basis 80% Pb, $75; average selling price, all grades of lead, $74.91.

Shipments the week: Blende, 8191 tons; calamine, 677 tons; lead, 1032 tons. Value, all ores the week, $587,280.

Some of the ore reported out this week has been under shipment for the last three weeks, but not reported until settlement was made. For this reason the shipments as shown by the record are out of proportion to the actual shipment of the week, which was notable for a deplorable lack of cars.

Platteville, Wis., Nov. 17—Blende, basis 60% Zn, $62 for premium grade down to $57 base for second grade. Lead ore, basis 80% Pb, $65 per ton. Shipments reported for the week are 2886 tons of zinc ore, 32 tons of lead ore, and 451 tons of sulphur ore. For the year to date the figures are: 128,026 tons of zinc ore, 6397 tons of lead ore, and 25,149 tons of sulphur ore. Shipped during the week to separating plants, 4038 tons of zinc ore.

Other Ores

Antimony Ore—Quoted nominally at $1.50 @1.75 per unit.

Chrome Ore—An important buyer of chrome ore in California is purchasing on the following schedule: For ore assaying 40% or more chromic oxide, 70 to 85c. per unit, according to grade and point of shipment; for ore assaying 35 to 40% chromic oxide, 60 to 70c. per unit.

Manganese Ore—Metallurgical ore is unchanged at $1.20 per unit.

Manganese-ore exports from Brazil, which were 183,630 tons in 1914, increased to 288,671 tons in 1915 and 503,120 tons in 1916. The increase was mainly in shipments to the United States.

Molybdenum Ore—Sales reported at $2.20 per lb. on the basis of 90% molybdenum sulphide.

Pyrites—Spanish lump quoted at 15c. per unit, on basis of 10s. ocean freight, buyer to pay excess freight and war risk, except that concession of 2% of war risk is allowed. Ocean rates remain at 35s. for Northern, 40s. for Southern and 42s. 6d. for Gulf ports.

Tungsten Ore—Conditions continue about as we reported last week. Prices remain unchanged.

Iron Trade Review

PITTSBURGH—Nov. 20

Conditions as to production of iron and steel have become still more unsatisfactory. While there is less idleness at steel plants on account of lack of coal than there was a fortnight ago there is still considerable restriction and the coal supplies that are obtained are secured only with the greatest difficulty, by priority orders and personally conducted shipments. Coke shipments in the last 10 days have been the poorest for a long time and many furnaces may have to bank. Many of the railroad divisions are badly congested and there are many embargoes.

Offerings of steel at the set prices are greater, and producers are in many instances evidently not as well filled up as they led the trade to believe, before the Government prices were set. In the majority of commodities it is possible to buy for early deliveries. In sheet and tin plates, contracts for the next half-year can be placed by regular customers of the mills, while in tubular goods sales are not being made so far ahead, and the same is largely true of bars, shapes and plates.

Much interest is manifested in the Government's prospective list of unessential industrial activities, as this may shut off some steel consumption. On the other hand, Government orders for steel are increasing.

Bristol furnace, Bristol, Va., owned by the Virginia Iron, Coal and Coke Co. and idle since 1908, has been sold to a Philadelphian. It will be dismantled and the ironwork and machinery shipped to Japan.

Electric furnaces in Canada produced 18,797 tons of steel in the first half of 1917. This compares with 19,639 tons for the entire year 1916.

Pig Iron—The market is quieter. There is less demand and furnaces have less to offer. Last week the Fuel Administration instructed coke operators to ship furnace coke to the exclusion of foundry, and while this may help the furnaces a trifle, those that are making foundry iron are fearful it will result in the consumption of foundry iron being decreased. We quote the market at the set prices: Bessemer, $36.30; No. 2 foundry and basic, $33; malleable, $33.50, f.o.b. valley furnaces, 95c. higher delivered Pittsburgh.

Steel—There are scarcely any offerings of unfinished steel, except occasional odd lots. We quote the market at the set prices: Billets, $47.50; small billets, $51; slabs, $50; sheet bars, $51, f.o.b. mill, Pittsburgh or Youngstown. Ingots have sold at above the billet price and are very scarce.

Ferroalloys

Ferromanganese — The market is more clearly defined than for some time past, quotations having settled down to a basis of $250 delivered, for prompt or forward, while sales when effected are usually at cuts of from $1 to $4 a ton below this figure. A few days ago a steel interest inquired for 1500 tons for first half, but being able to shade $250 only a trifle concluded to buy only 250 tons.

Coke

Connellsville—Car supplies were particularly poor last week and are no better this week, shipments being estimated at between two-thirds and three-fourths of the average rate of the last few months, which rate was not sufficient to supply the furnaces fully. Beehive coke remains at the set prices of $6 for furnace, $7 for 72-hour selected foundry and $7.30 for crushed, over 1-in. size. The Fuel Administration has just set byproduct-coke prices at the same levels, except that crushed is $6.50, all prices being per net ton at ovens.

STOCK QUOTATIONS

N. Y. EXCH.†	Nov. 20
Alaska Gold M	2⅛
Alaska Juneau	2⅛
Am.Sm.& Ref.,com.	75⅛
Am. Sm. & Ref., pf.	101⅛
Am. Sm. Sec., pf., A	‡92⅛
Am. Sm. Sec., pf. B	‡96
Am. Zinc	13
Am. Zinc, pf	42
Anaconda	57⅛
Batopilas Min	1
Bethlehem Steel	82⅛
Bethlehem Steel, pf.	85
Butte & Superior	16⅛
Cerro de Pasco	32
Chile Cop	14⅛
Chino	41⅛
Colo.Fuel & Iron	34⅛
Crucible Steel	56⅛
Dome Mines	6⅛
Federal M. & S	12
Federal M. & S., pf.	34
Great Nor., ore ctf.	26
Greene Cananea	34
Gulf States Steel	85⅛
Homestake	92⅛
Inspiration Con	43⅛
International Nickel	22
Kennecott	33⅛
Lackawanna Steel	77⅛
Miami Copper	28⅛
Nat'l Lead, com	44⅛
National Lead, pf	100⅛
Nev. Consol	17⅛
Ontario Min	4
Quicksilver	.75
Quicksilver, pf	1
Ray Con	22⅛
Republic I.&S.,com.	74⅛
Republic I. & S., pf.	92
Sloss-Sheffield	36
Tennessee C. & C	12⅛
U. S. Steel, com	96⅛
U. S. Steel, pf	108⅛
Utah Copper	78
Va. Iron C. & C	52

N. Y. CURB†	Nov. 20
Big Ledge	1⅛
Butte & N. Y	.50
Butte C. & Z	6⅛
Butte Detroit	⅛
Caledonia	.45
Calumet & Jerome	1⅛
Can. Cop. Corpn	2
Carlisle	3⅛
Cashboy	.04
Con. Ariz. Sm	1 1/16
Con. Coppermines	7⅛
Con. Nev.-Utah	1/16
Emma Con	.50
First Nat. Cop	2⅛
Goldfield Con	.40
Goldfield Merger	.04
Greenmonster	1 1/16
Hecla Min	4 3/16
Howe Sound	3⅛
Jerome Verde	1/16
Kerr Lake	4⅛
Louisiana	⅛
Magma	37⅛
Majestic	.28
McKinley-Dar-Sa	.60
Milford	1⅛
Mohican	1/16
Mother Lode	.37
N. Y. & Hond	12
Nipissing Mines	8
Nixon Nevada	1 1/16
Ohio Cop	1
Ray Hercules	3⅛
Richmond	‡.56
Rochester Mines	.36
St. Joseph Lead	16
Standard S. L	1/16
Stewart	.25
Success	.13
Tonopah	4⅛
Tonopah Ex	1 1/16
Tribullion	⅛
Troy Arizona	.19
United Cop	.50
United Verde Ext	31
United Zinc	1⅛
Utica Mines	.12
Yukon Gold	1⅛

SAN FRAN.*	Nov. 20
Alta	.03
Andes	.10
Best & Belcher	.03
Bullion	.01
Caledonia	.10
Challenge Con	.04
Confidence	.03
Con. Virginia	.13
Gould & Curry	.01
Hale & Norcross	.03
Jacket-Cr. Pt	.09
Mexican	.18
Occidental	.60
Ophir	.13
Overman	.04
Savage	.04
Sierra Nevada	.08
Union Con	1.27½
Utah Con	.01
Belmont	3.50
Jim Butler	.75
MacNamara	.19
Midway	.09
Mont.-Tonopah	.10
North Star	.06
Rescue Eula	.09
West End Con	.64
Atlanta	.08
Booth	.04
Comb. Frac	‡.03
D'field Daisy	‡.02
Florence	.10
Jumbo Extension	.15
Kewanas	.05
Nevada Hills	.07
Nevada Packard	.22
Round Mountain	.20
Silver Pick	.08
White Caps	.74
Big Jim	‡.75
United Eastern	3.50

BOSTON EXCH.*	Nov. 20
Adventure	1⅛
Ahmeek	84
Algomah	.25
Alloues	53
Ariz. Com., ctfs	9⅛
Arnold	‡.25
Bonanza	.21
Butte-Balaklava	.32
Calumet & Ariz	65
Calumet & Hecla	440
Centennial	13
Copper Range	47⅛
Daly West	2
Davis-Daly	3⅛
East Butte	10
Franklin	4⅛
Granby	65
Hancock	8⅛
Hedley	‡16⅛
Helvetia	.25
Indiana	1
Isle Royale	24
Keweenaw	1⅛
Lake	6⅛
La Salle	2⅛
Mason Valley	4
Mass	6⅛
Mayflower	1⅛
Michigan	1⅛
Mohawk	61
New Arcadian	2
New Idria	10
North Butte	13
North Lake	.35
Ojibway	1⅛
Old Dominion	36⅛
Osceola	60
Quincy	66⅛
St. Mary's M. L	52
Santa Fe	.80
Seneca	16
Shannon	5⅛
Shattuck-Ariz	20
So. Lake	1⅛
So. Utah	.17
Superior	4⅛
Superior & Bost	3
Trinity	4
Tuolumne	1⅛
U. S. Smelting	44
U. S. Smelt'g, pf	44⅛
Utah Apex	2
Utah Con	12
Utah Metal	3⅛
Victoria	2
Winona	1
Wolverine	33
Wyandot	.50

BOSTON CURB*	Nov. 20
Alaska Mines Corp	.12
Bingham Mines	9⅛
Boston Ely	.45
Boston & Mont	.50
Butte & Lon'n Dev	.13
Calaveras	1⅛
Calumet-Corbin	‡.01
Chief Con	1⅛
Cortez	.10
Crown Reserve	.24
Crystal Cop	.60
Eagle & Blue Bell	.2
Gila Copper	.17
Houghton Copper	.50
Intermountain	1
Iron Cap, Com	13⅛
Iron Cap Cop., pf	14⅛
Mexican Metals	.26
Mines of America	1⅛
Mojave Tungsten	.32
Nat. Zinc & Lead	.30
Nevada-Douglas	1 1/16
New Baltic	.75
New Cornelia	14⅛
Oneco	.25
Pacific Mines	‡.35
Rex Cons	.06

SALT LAKE*	Nov. 20
Bannack	.26
Big Four	.01
Cardiff	3.10
Colorado Mining	.11
Daly	1.40
Daly-Judge	6.75
Empire Copper	1.17
Gold Chain	.14
Grand Central	.47
Iron Blossom	.48
Lower Mammoth	.03
May Day	.03
Moscow	.11
Prince Con	.61
Rico Wellington	.19
Silver-King Coal'n	2.35
Silver King Con	3.15
Sioux Con	.03
So. Hecla	1.00
Tintic Standard	1.45
Uncle Sam	.02
Wilbert	.14
Yankee	.03

TORONTO*	Nov. 20
Adanac	.11
Bailey	.04
Beaver Con	.28
Chambers Ferland	.10
Conlagas	2.90
Hargraves	.08
La Rose	.31
Peterson Lake	.08
Temiskaming	.25
Wettlaufer-Lor	.05
Davidson	.32
Dome Exten	.09
Dome Lake	.12
Hollinger	4.55
McIntyre	1.25
Newray	.45
Porcu. Crown	.20
Teck-Hughes	.33
Vipond	.17
West Dome	.14

STOCK QUOTATIONS—Continued

COLO. SPRINGS	Nov. 20
Cresson Con	4.43½
Doctor Jack Pot	.03½
Elkton Con	.03½
El Paso	.15
Gold Sovereign	.02½
Golden Cycle	1.67
Granite	.35
Isabella	.07½
Mary McKinney	.06½
Portland	1.00
United Gold M	.15½
Vindicator	.34½

LONDON	N . 5
Alaska Tre'dwell	‡£1 0s 0d
Burma Corp	4 1 3
Cam & Motor	0 12 0
Camp Bird	0 8 0
El Oro	0 10 0
Esperanza	0 8 6
Mexican Mines	5 17 6
Min. Corp. Can.	0 17 3
Nechi, pfd	0 10 0
Oroville	0 18 6
Santa Gert'dis.	0 14 6
Tomboy	1 1 0

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1915	1916	1917	1915	1916	1917
Jan.	48.855	56.775	75.630	22.731	26.960	36.682
Feb.	48.477	56.755	77.585	22.753	26.975	37.742
Mar.	50.241	57.935	73.861	23.708	27.597	36.410
April	50.250	64.415	73.875	23.709	30.662	36.963
May	49.915	74.269	74.745	23.570	35.477	37.940
June	49.034	65.024	76.971	23.267	31.060	39.065
July	47.519	62.940	79.010	22.597	30.000	40.110
Aug	47.163	66.083	85.407	22.780	31.498	43.418
Sept.	48.680	68.515	100.740	23.591	32.584	50.920
Oct.	49.385	67.855	87.332	23.925	32.361	44.324
Nov.	51.714	71.604	.....	25.094	34.192	.....
Dec.	54.971	75.765	.....	26.373	36.410	.....
Year	49.684	65.661	.....	23.675	31.315	.....

New York quotations cents per ounce troy, fine silver London, pence per ounce, sterling silver, 0.925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1916	1917	1916	1917	1916	1917
Jan.	24.008	28.673	88.083	131.921	116.167	142.895
Feb.	26.440	31.750	102.667	137.895	133.167	148.100
Mar.	26.310	31.481	107.714	136.750	136.000	151.000
April	27.895	27.935	124.319	133.842	137.389	147.158
May	28.625	28.788	135.457	130.000	152.522	142.000
June	26.601	29.962	112.432	130.000	137.455	142.000
July	23.865	26.620	95.119	128.409	125.500	140.409
Aug.	26.120	25.380	110.283	122.391	126.304	137.000
Sept.	26.855	25.073	113.905	117.500	134.071	135.250
Oct.	27.193	23.500	122.750	110.000	142.523	125.000
Nov.	30.625	.....	134.659	.....	155.432	.....
Dec.	31.890	.....	145.316	.....	162.842	.....
Year	27.202	.....	116.059	.....	138.281	.....

Tin	New York		London	
	1916	1917	1916	1917
January	41.825	44.175	175.548	185.813
February	42.717	51.420	181.107	198.974
March	50.741	54.388	193.609	207.443
April	51.230	55.910	199.736	220.171
May	49.125	63.173	196.511	245.114
June	42.231	62.053	179.466	242.083
July	38.510	62.570	168.357	242.181
August	38.565	62.681	169.870	243.978
September	38.830	61.542	171.345	244.038
October	41.241	61.851	179.307	247.467
November	44.109	.....	186.932	.....
December	42.635	.....	183.368	.....
Av. year	43.480	.....	182.096	.....

Lead	New York		St. Louis		London	
	1916	1917	1916	1917	1916	1917
January	5.921	7.626	5.826	7.530	31.167	30.500
February	6.246	8.636	6.164	8.595	31.988	30.500
March	7.136	9.199	7.375	9.120	34.440	30.500
April	7.630	9.288	7.655	9.158	34.368	30.500
May	7.463	10.207	7.332	10.202	32.967	30.500
June	6.936	11.171	6.749	11.123	31.011	30.500
July	6.352	10.710	6.185	10.644	28.137	30.500
August	6.244	10.594	6.088	10.518	29.734	30.500
September	6.810	8.680	6.699	8.611	30.786	30.500
October	7.000	6.710	6.898	6.650	30.716	30.500
November	7.042	.....	6.945	.....	30.500	.....
December	7.513	.....	7.405	.....	30.500	.....
Year	6.853	.....	6.777	.....	31.359	.....

Spelter	New York		St. Louis		London	
	1916	1917	1916	1917	1916	1917
Jan.	16.915	9.619	16.745	9.449	89.810	48.329
Feb	18.420	10.045	18.260	9.875	97.762	47.000
Mar.	16.846	10.300	16.676	10.130	95.048	47.000
April	16.695	9.459	16.525	9.289	99.056	54.632
May	14.276	9.362	14.106	9.192	94.217	54.000
June	11.752	9.371	11.582	9.201	68.591	54.000
July	8.925	8.643	8.755	8.473	50.750	54.000
Aug	8.730	8.360	8.560	8.190	51.587	54.000
Sept.	8.990	8.136	8.820	7.966	52.095	54.000
Oct.	9.829	7.983	9.659	7.813	54.159	54.000
Nov	11.592	.....	11.422	.....	56.023	.....
Dec	10.665	.....	10.495	.....	55.842	.....
Year	12.804	.....	12.634	.....	72.071	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Pig Iron, Pgh.	Bessemer‡		Basic‡		No. 2 Foundry	
	1916	1917	1916	1917	1916	1917
January	$21.60	$35.95	$18.78	$30.95	$19.70	$30.95
February	21.16	36.37	18.93	30.95	19.51	30.95
March	21.81	37.37	19.20	33.49	19.45	35.91
April	21.65	42.23	18.95	38.90	19.45	40.06
May	21.78	46.94	19.11	42.84	19.58	43.60
June	21.95	54.22	18.95	50.05	19.34	50.14
July	21.95	57.45	18.95	53.80	19.20	53.95
August	21.95	54.17	18.95	50.37	19.22	53.95
September	22.88	46.40	19.58	42.24	19.53	48.58
October	24.61	37.25	21.26	33.95	21.51	33.95
November	30.07	.....	28.18	.....	26.55	.....
December	35.16	.....	30.95	.....	30.79	.....
Year	$23.88	.....	$20.98	.....	$21.15	.....

‡ As reported by W. P. Snyder & Co.